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# Textured Enhanced Image De-noising using Fast Wavelet Transform

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**Abstract**: The digital imaging technologies possess very hasty development that uses Giga-pixels to store an image. Image de-noising algorithms plays a significant role in the restoration process. In an image the texture regions are homogeneous and are composed of local descriptor, a trade off exist between visual quality of image and the enhanced texture regions. In the existing paper the Gradient Histogram Preservation (GHP) method on the enhanced image regions have a limitation where it cannot be directly applied to non-additive noise removal such as Multiplicative Poisson Noise (MPN) and Signal-Dependent Noise (SDN) to overcome the limitation Fast Wavelet Transform is used. In this work an image is first added with different types of noise like Additive White Gaussian Noise (AWGN), Salt and Pepper Noise, Poisson Noise, Signal Dependent noise and Flicker Noise, the noisy image is restored using filters, next the enhanced texture region of the image is chosen which is blurred or deformed and the fine details of the texture is obtained using Fast Wavelet Transform (FWT). The proposed work is analyzed in Frequency domain by considering various parameters like Peak Signal to Noise Ratio (PSNR), Correlation Factor (CF) and Standard Deviation (SD) and the quality of the enhanced region of the image is improved to the best level than the conventional noise removal algorithms.

**Keywords**: Image Textures; Fast Wavelet Transform; Peak Signal to Noise Ratio; Correlation Factor; Standard Deviation.

## 1. INTRODUCTION

Image Noise models can be classified into two groups. They are $(i)$ Image Independent Noise Model and $(ii)$ Image Dependent Noise Model. Image independent noise can be described by an additive noise model by the equation 1.

$$f(i,j) = s(i,j) + n(i,j) \quad (1)$$

Where $f(i,j)$the processed image or Noisy image is, $s(i,j)$ is the true image without addition of noise and $n(i,j)$ is the additive noise on the true image. Noise $n(i,j)$ is often zero mean and described by its variance$\sigma_n^2$. Signal to Noise Ratio (SNR) is defined as

$$SNR = \frac{\sigma_s}{\sigma_n} = \sqrt{\frac{\sigma_f^2}{\sigma_n^2} - 1} \quad (2)$$

In the above equation 2, $\sigma_s^2$ the variance of true image and $\sigma_f^2$ is the variance of processed image. In several cases, white additive noise is evenly distributed over the frequency domain. Where white noise is one of the random signal as shown in Figure 1, having equal intensities at different frequencies and it has a constant power spectral density.

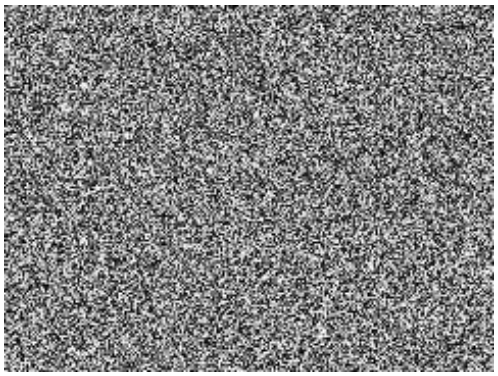


Figure 1. White Noise Image

Data or Image dependent noise model is done with a non linear model or multiplicative model. The image dependent noise models are more complicated, one of the example is an image resulted due to the addition of monochromatic radiation getting scattered from a surface whose irregularities or roughness is of the order of a wavelength which causes interference and it results in speckle noise.

A widespread signal-dependent noise model has been anticipated to deal with numerous diverse acquisition systems. Many types of noise can be described by using the following parametric model equation 3.

$$g(m,n) = f(m,n) + f(m,n)\gamma \cdot u(m,n) + w(m,n) = f(m,n) + v(m,n) + w(m,n) \quad (3)$$

Where $(m,n)$ is the pixel location, $g(m,n)$ the observed noisy image, $f(m,n)$ the noise-free image, modelled as a non-stationary correlated random process, $u(m,n)$ a stationary, zero-mean uncorrelated random process independent of $f(m,n)$ with variance$\sigma 2\ u$, and $w(m,n)$ is electronics noise (zero-mean white and Gaussian, with variance σ2). For a great variety of images, this model has been proven to hold for values of the parameter γ such that$|\gamma| \leq 1$. The additive term $v = f\gamma \cdot u$ is the generalized signal-dependent (GSD) noise. Since 'f' is generally non-stationary, the noise v will be non-stationary as well. The term w is the signal-independent noise component and is generally assumed to be Gaussian distributed. [2]

## 2. PROBLEM STATEMENT

The dilemma of getting better the regression function from noisy data based on wavelet decomposition. To restrain the noise in the data two approaches are normally used. The primary scheme is the called linear method. The wavelet decomposition echo's healthy the properties of the signal in the frequency domain. It is known that the higher decomposition scales related to higher frequency components in the regression function. . If we suppose that the fundamental regression is owed in the low frequency domain then the filtering process becomes evident. All empirical wavelet coefficients ahead of

some resolution scale are anticipated by zero. This modus operandi works well if the signal is adequately smooth and whilst there is no edge effect in the data. But for several practical problems such a loom do not give the impression to be fully apposite, e.g. images cannot be painstaking as smooth functions.

To shun this inadequacy often a nonlinear filtering modus operandi is worn to hold back the noise in the empirical wavelet coefficients. The focal idea is based on the elementary property of the wavelet transform; father and mother functions are sound localized in time domain. Consequently one can estimate the empirical wavelet coefficients independently. To perform this approach compares the standard deviation of the noise and the absolute value of the empirical wavelet coefficient. It is lucid that if the wavelet coefficient is of the same order to that of the noise level, then it is difficult to separate the noise and the signal. In this state of affairs a high-quality estimator for the wavelet coefficient is nil. In the crate after an empirical wavelet coefficient is superior to the noise level a usual estimator for a wavelet coefficient is the empirical wavelet coefficient itself it is called thresholding. Hence divide the diverse adjustments of thresholding in principally three methods: Hard Thresholding, Soft Thresholding and a Levelwise Thresholding using Stein risk estimator.

## 3. LITERATURE SURVEY

The author proposed very effective denoising algorithm based on gradient histogram preservation which shows good PSNR/SSIM value. This approach is very logical working as a comparator circuit of OP-AMP and it work globally for any noisy image mathematically by using adaptive algorithm. This method is not applicable for multiplicative Poisson noise and signal dependent noise [1].

In this method various optical imaging instrument such as CCD (Charge Coupled Device) cameras, multispectral scanners and imaging spectrometers are used to estimate the noise. It depends on multivariate regression such as mean and variance. The method provides good accuracy, SNR and it is robust to the image textures which lead to over estimation of noise [2].

When the data samples are finite or quantized and non-parametric in nature then the noise estimation is done commonly using kernel density estimation where if the data samples are in parametric in nature then it is estimated empirically. Here Gradient Decent and expectation maximum techniques for max. Likelihood optimization is developed and it results in good smooth optimization [3].

In this method the digital image is degraded and restored using non linear filters called histogram adaptive fuzzy filter. The process is carefully checked and compared using other methods like Adaptive fuzzy mean filter, minimum-maximum detector based filter, minimum-maximum exclusive filter and weighted adaptive fuzzy mean. The PSNR is best compared with above methods [4].

Here the author concentrated on image and video signal for denoising the work is done using wavelet thresholding methods for removing various types of noises on the image and video signals. The various parameters like PSNR, correlation factor and MSE are calculated. [5]

## 4. IMAGE DENOISING BLOCK DIAGRAM

In the process of image noising the non linear noise model is used where the noise is added in the channel being used to propagate the image signal. Here uncompressed image of TIFF (Tagged Image File Format) is used for processing the main objective is to remove the noise present on the image which got attacked in the noisy channel. Fast wavelet transforms like haar, db2, db4, db6, db8, Symlet, Cofilet and bi-orthogonal are used to remove the noise from the noisy image. The entire process is shown in the below figure 2.


Figure 2. Image denoising block diagram

### 4.1 Hard Thresholding

To hold back the noise relates the following nonlinear transform to the empirical wavelet coefficients as shown in the equation 4.

$$F(x) = x.I(|x| > t) \quad (4)$$

Where‘t’ is a firm threshold. The selection of the threshold is a very fragile and vital statistical problem. On one hand, a immense threshold guides to a huge bias of the estimator. Nevertheless on the other hand, a tiny threshold increases the variance of the smoother. Hypothetical concern capitulate the threshold as shown in equation 5.

$$t = \sqrt{2\sigma^2 \log(n)/n} \quad (5)$$

Where ‘n’ is the length of the input vector
and $\sigma^2$ is the variance of the noise

### 4.2 Soft Thresholding

The only difference between the hard and the soft thresholding measures are in the choice of the nonlinear transform on the empirical wavelet coefficients. For soft thresholding the following nonlinear transform is used

$$S(x) = sign\,(x)\big(|x| - t\,I(|x| > t)\big) \quad (7)$$

where ‘t’ is a threshold. The set of choices provides you with all possibilities for choosing the threshold and discover the data.

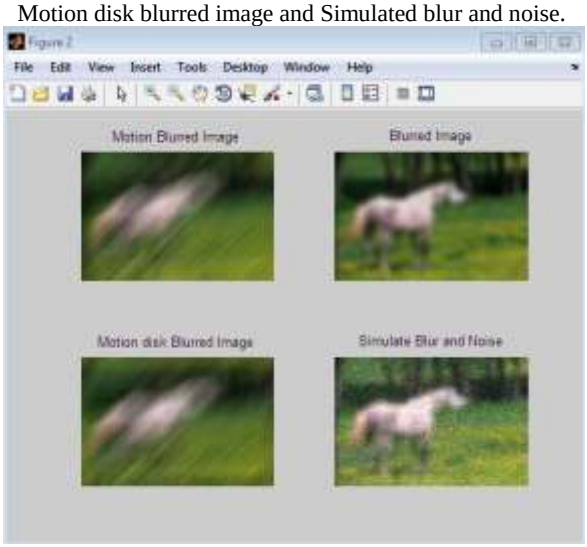
### 4.3 Adaptive Thresholding

Adaptive thresholding using Stein's principle is as follows, We define a risk function $R(s_t, Z_k, t)$ with $Z_k = c_k + s_k e_k, k = 1,2,\ldots M$where $c_k$ is the unknown coefficient, $s_k$ is the scaled parameter, $e_k$ is i.i.d $N(0,1)$ random variable and t the threshold. Stein enables us to estimate the risk $\sum_{k=1}^{M} R(s_k, Z_k, t)$ the risk minimizing argument $\hat{t}$ can also be estimated and will be taken then as the optimal adaptive threshold ‘t’.

$$\hat{t} = \arg\min_{t\geq 0} \sum_{k=1}^{M} \left(2s_k^2 + t^2 - Z_k^2\right) I\{|Z_k| \geq t\} \quad (8)$$

## 5. RESULTS

The objective of image denoising is attained fruitfully with various thresholds. The below figure 3 shows the various noisy images like motion blurred image, blurred image, Motion disk blurred image and Simulated blur and noise.



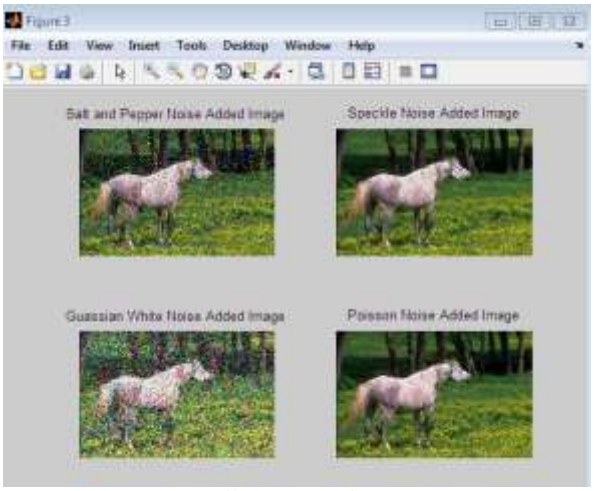




Figure 4. Different kinds of Noisy images

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In the figure 4 salt and pepper noise, speckle noise, Gaussian white noise and Poisson Noise are added and respective figures are shown above. The PSNR of the results is shown in the below Figure 5.

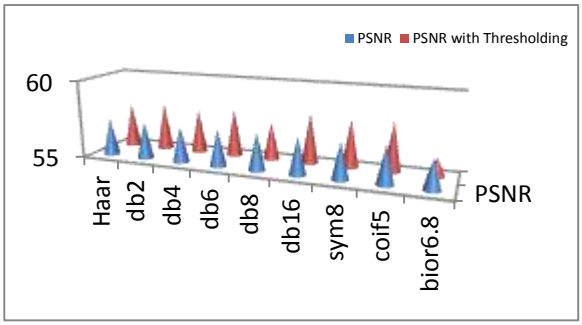


Figure 5. PSNR values without and with adaptive thresholding

Figure 3. Various Blur with Noises


Figure 6. Image processed by db16 wavelet.

The above figure 6 shows the image being processed with db16 wavelet for image denoising with adaptive thresholding method and figure 7, shows the corresponding PSNR values in chart.

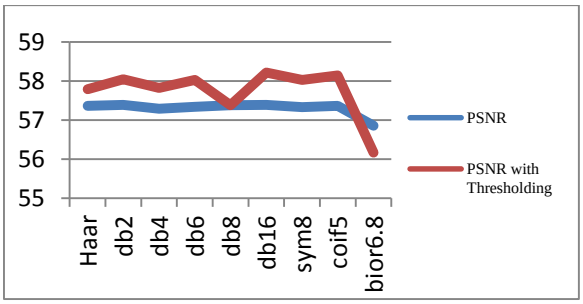


Figure 7. PSNR values of various wavelet transform

## 6. CONCLUSION

In the process of image denoising proper preprossing filter is used where the pre-processing filters are Median filer, Averaging filter, and mean filter. The best method to remove the signal dependent noise is to use wavelets in which the noise is removed in by using adaptive thresholding method. The PSNR value of different wavelets has been observed. The db8 and db16 wavelets are best suited for White Gaussian noise intensities, for speckle noise haar and family of daubechies wavelets can be used. The Best PSNR value is observed is 58.865 for Coiflet transform and daubechies transform with 58.85.

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# Activity Context Modeling in Context-Aware Environment

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**Abstract**: The explosion of mobile devices has fuelled the advancement of pervasive computing to provide personal assistance in this information-driven world. Pervasive computing takes advantage of context-aware computing to track, use and adapt to contextual information. The context that has attracted the attention of many researchers is the activity context. There are six major techniques that are used to model activity context. These techniques are key-value, logic-based, ontology-based, object-oriented, mark-up schemes and graphical. This paper analyses these techniques in detail by describing how each technique is implemented while reviewing their pros and cons. The paper ends with a hybrid modeling method that fits heterogeneous environment while considering the entire of modeling through data acquisition and utilization stages. The modeling stages of activity context are data sensation, data abstraction and reasoning and planning. The work revealed that mark-up schemes and object-oriented are best applicable at the data sensation stage. Key-value and object-oriented techniques fairly support data abstraction stage whereas the logic-based and ontology-based techniques are the ideal techniques for reasoning and planning stage. In a distributed system, mark-up schemes are very useful in data communication over a network and graphical technique should be used when saving context data into database.

**Keywords**: context; context modeling; context-aware computing; hybrid context model; mobile computing; pervasive computing

## 1. INTRODUCTION

With the proliferation of mobile devices, one looks to pervasive computing to provide personal assistance in this digital world. Pervasive computing refers to obtaining available data any time at any place. One critical aspect of pervasive computing is context-aware computing in which applications are made to track, use and adapt to contextual information. The definition of context by Dey and Abowd [1] which is also adopted in this work is, "*Any information that can be used to characterize the situation of an entity. An entity is a person, place or object that is considered relevant to the interaction between a user and an application including the user and application themselves*". The relatively important contexts [2], [3] are location, time, identity and activity. The first three contexts are obtained through well-known mechanisms. The location context can be determined when the device is outdoor through Global Positioning System (GPS) [4] or indoor through radio frequency technologies like Bluetooth [5]. Concerning the time of the day, the clock system of a mobile device can be used in connection with external authenticated system [6]. However, many techniques are employed in tracking activity context. This paper reviews the prominent techniques stating the pros and cons of the various mechanisms. The paper ends with the best approach for activity modeling through the various stages of data acquisition and interpretation.

Context modeling is the process of identifying the appropriate contextual information of interest and establishing relationships and reactions among the pieces of contextual information. Schmohl and Baumgarten in [7] suggested that context modelling requires two phases: the first phase is to determine the conceptual abstraction of real world characteristics. The second phase is to map the concepts on a context model that represent the information. To sense and interpret contextual information, many components are required. The core components are sensors, middleware, context repository, context reasoning and communication interface. Context sensor can be hardware or software that fetches raw data for contextual information. Because the raw data cannot be interpreted by high level languages [8], there is the need for a middleware that refines the raw data from sensors into the required data structures [9]. The context repository stores the current context based on the data structures generated by the middleware. Context reasoning infers new context based on the current context information obtained from the middleware. The context reasoning relies on a set of rules [10] to infer the new context. Communication interface is required in distributed system. Reasoning mechanism may commit contextual updates into a network or may request contextual information through a network. The context reasoning after inference passes the message to the context-aware application which uses the information to adapt itself through the execution or termination of certain programs. A conceptual view of the context utilization mechanism is illustrated below:

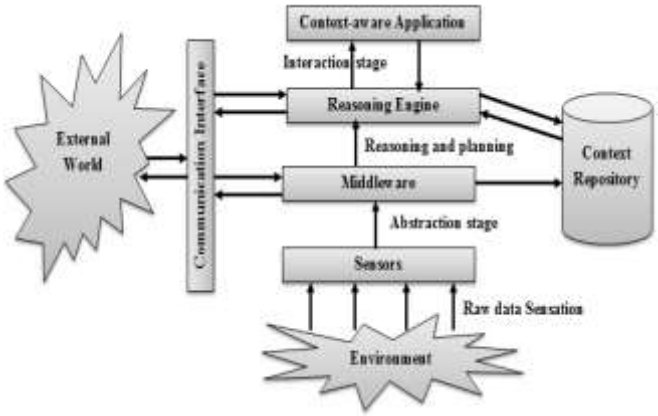


Figure 1 Context Acquisition and Utilization Framework

There are six mechanisms or models that can be used to sense and interpret a context within the various components stated above. These are key-value, mark-up scheme, graphical, object-oriented, logic-based and ontology-based models

## 2. MODELING TECHNIQUES

The six modeling techniques that can be used to model activity context are discussed in details below. To illustrate how each model is implemented, the following case study is model during the discussion of the various techniques. "A computer science book (BK) is read by computer scientist (CS). BK has Title, ISBN; Author, Barcode as its attributes. The title and author are string data type whereas ISBN and Barcode are integer data type. The author is usually computer scientist who of course is a human. Humans are characterized by name and age being string and integer data types respectively."

### 2.1 Key-Value Models

They require simple data structures to associate context attributes with specific values of conceptual information [7]. Schilit et al in [11] used key-value pairs to model the context by assigning the value of context information to an environment variable in an application. From the case study above, the characteristics of the entities – BK and CS – which form the keywords for the modeling are:

- **BK**: title, ISBN, author, barcode
- **CS**: name, age

Since human and CS are the same in terms of characteristics, human is ignored in the modeling. The characteristics that can be used to identify BK are ISBN and barcode. Both features are of integer data types, though barcode are sometimes alphanumeric. This work restricts itself to only numeric barcodes. It is therefore not applicable to alphanumeric barcodes. There is other integer feature called age that belongs to CS. However, the length of age should not be more than three. Barcode has varying length but usually more than three. Similarly, the length of ISBN is more than three. Hence, every set of data consisting of numeric characters with length greater than 3, is associated with BK. The other features of BK are author and title. They cannot be used in our model since author and title consist of set of characters similar to the features of CS. Thus to avoid ambiguity, author and title are ignored. Similarly, the name feature of CS is also ignored. Regarding CS, the characteristics the can be used to identify CA is the age. Thus if the data is integer with length less than or equal to three, then CS is being referenced. The figure below gives the key-value model for the above case study

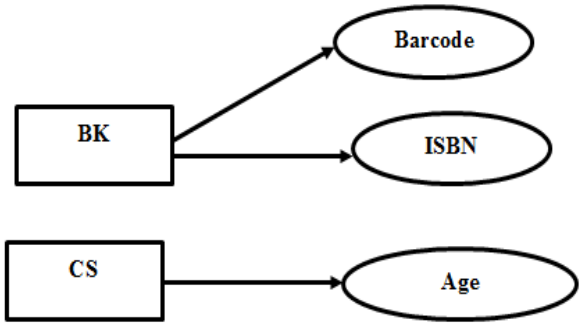


Figure 2 Key-Value Sample Model

There is no relationship established between BK and CS as discussed above. The characteristics provided should be followed closely so that entities can be identified and reasoning inferred. It can be deduced that key-value model is flexible and easy to manage in a small system. However, the model limits the amount of data. The model is also application dependent and is not adaptive. There is no validation support and relationship modeling.

### 2.2 Mark-up scheme models

They used hierarchical data structures based on mark-up tags with attributes and comments. It is based on serialization of Standard Generic Mark-up Language (SGML), the superclass of all mark-up languages. Among the commonly used mark-up schemes are eXensible Mark-up Language (XML) and Resource Description Framework (RDF). XML is used to package data or information and RDF is used for conceptual description or modelling in web resources using a data serialization format. The above case study is designed using XML. XML file cannot contain multiple root elements. Thus each root element – BK, CS and Human – are contained in separate files. In the figure below, only section of BK is implemented.

```
1  <?xml version="1.0" encoding="utf-8" ?>
2      <CSBooks>
3          <BK>
4              <title>some data</title>
5              <author>some data</author>
6              <isbn>some data</isbn>
7              <barcode>some data</barcode>
8          </BK>
9          <BK>
10             .
11             .
12             .
13         </BK>
14         .
15         .
16         .
17     </CSBook>
18
```

Figure 3 Mark-up Sample Model

Some researchers extended RDF capabilities to Composite Capabilities/Preferences Profile (CC/PP) [12] and User Agent Profile (UAProf) [13] which allow the definition and preferences in context delivery. For instance, in [14] and [15], the researchers designed Comprehensive Structured Context Profile (CSCP) and CC/PP Context Extension respectively to handle the limitation of CC/PP. The limitation of CC/PP is that it allows specific values only. Another context modelling approach which does not follow CC/PP is the pervasive Profile Description Language (PPDL) [16]. This is an XML-based language for designing interaction patterns on limited scales. In order to reduce bandwidth consumption, XML can be combined with JavaScript Object Notation (JSON) [17] which reduces the transmission time of context-aware applications. JSON is lightweight data exchange format that allows computers to generate and parse data easily and faster. Mark-up schemes are flexible and structured. There are available tools for processing and very useful when data is travelled along a network or communication link. Unfortunately, mark-up schemes depend on the application and information is hard to extract.

### 2.3 Graphical models

They represent contextual entities and their relationships graphically using tools like Uniform Modelling Language (UML) and Entity Relationships (ER) schemas. UML is very

expressive since it uses directed graph to indicate the relationships between concepts. However, it is difficult to work with UML [18] due to its increasing complexity. As of 2016, there are more than fourteen different diagrams making it virtually impossible for developers to recognize. ER on the other hand describes conceptual pieces as entities and the interactions as relationships. The major limitation of ER is the lack of semantics between the entities due to limited representation of relationships, data manipulation, constraints and specifications between entities. The above case study is modeled using ER. The entities in the case study are CS, BK and Human

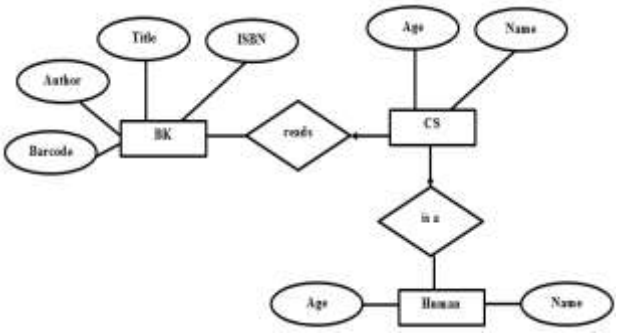


Figure 4 Sample Entity Relations Graphical Model

To handle the limitations of ER, extensions are provided by researchers through the additions of extra features in context modeling. Bauer in [19] used UML extensions to model air traffic management system. Another type of graphical model is the Object-Role Model (ORM) [20] which is a conceptual level modelling method to handle the semantics of data and its interrelationship among the data. ORM models concepts as facts [21]. The work in [22] extended ORM by employing contextual classification and description properties which introduced history fact to cover time aspect of the context and fact dependencies. Thus a change in one fact automatically leads to a change in another fact. According to Mohan and Singh in [21], formal semantics of ORM and Context Modeling Language (CML) can be supplemented to provide integration with other implementations. Graphical modeling technique as its strength provides relationship modeling, flexible implementation and it is very useful for data storage and historic context store [23]. However, the limitations of graphical modelling technique include its complexity to retrieve information which requires obligatory configuration. It does not support interoperability between heterogeneous implementations.

## 2.4 Object-Oriented Models

They employ the use of object-oriented characteristics such as encapsulation and reusability. Encapsulation hides the implementation of objects whiles reusability allows models to be reused. The Active Object Model of the GUIDE project in [24] was based on object-oriented model. In object-oriented model, entities are modeled using classes which are implemented as objects. The attributes are implemented as data fields or variable in object-oriented model whereas entity behaviors are modeled as methods (in Java) or functions (in C++). The above case study is modeled using Java in the figure below.

```
public class BK{
    private String title;
    private String author;
    private int isbn;
    private int barcode;

    //other methods and fields
    .
    .
    .
}

public class CS extends Human{
    //other methods and fields
}

public class Human{
    //other methods and fields
}
```

Figure 5 Object-Oriented Sample Model

The object-oriented model provides relationship modeling. The tools for processing are available and it allows every integration whiles supporting data transformation over network or communication link. It is however, limited by its complexity to retrieve information.

## 2.5 Logic-based Models

They use rules and expressions to define a context. Logics are used to define conditions for formulating expressions or facts. It is best used at the reasoning section of a context-aware application. The first logic based context modelling approach occurred in 1993 by McCarthy [25] and refined in 1997 [26]. The refined work introduced abstract mathematical entities complemented with useful properties in artificial intelligence which allowed simple axioms to be used in common sense phenomena. Akram and Surav in [27] tried to give theoretical semantic model of natural language in a formal logic system. Many researchers had focused on first order logic in their implementations. Gray and Salber in [28] used it to represent contextual propositions and relations. In [29], first order logic was used in connection with Boolean algebra to design middleware infrastructure called Gaia which allowed various rules to describe context information. It was used in [30] to describe context information properties and structure and the kinds of operations they can perform. Another application is to use logic based model with other modelling techniques. Gu et al in [31] proposed Service-Oriented Context-Aware Middleware (SOCAM) architecture for building context-aware services. In their model, first-order predicate calculus was used to model a context and used different modeling techniques, ontology based model written in Web Ontology Language (OWL) as a collection of RDF triples, to describe the context predicate. Using the first order logic, the following model can be obtained from the above case study:

$\forall x$, (is-isbn(x) $\vee$ is-barcode(x) => BK (x))

$\forall x$, ($\forall y$ (is-name(x) $\wedge$ is-age(y) => CS (x,y)))

$\forall x$, (is-CS(x) => is-Human (x))

$\forall x$, (is-BK(x) => ¬ is-CS (x))

$\forall x$, (is-BK(x) => ¬ is-Human (x))

$\exists x$ , ($\forall y$ ((is-author(x) ∧ is-title(x)) ∨ ¬ is-age (y)) => BK(x,y))).

The above first order logic can also be described using fuzzy logic. The figure below illustrates the fuzzy logic representation.

```
if (data set is isbn) or (data set is barcode) then
    data set represents BK
else if (data set is name) and (data set is age) then
    data set represents CS
    data set also represents Human
end if
```

Figure 6 Fuzzy Logic Sample Model

The strengths of logic-based model are that it generates high-level context based on low-level context. It is simple to use and simple to model. Its limitation is the complication of its applicability. It is also difficult to maintain due to partial validation

## 2.6 Ontology-based Models

Ontologies are used to represent concepts and their interrelationships. This model enables contextual knowledge sharing and reusability [7]. Ontologies are the most expressive context representation models [8] that support dynamic aspects of context awareness. However, they require ontology engines which have high requirements on resources producing negative performance impact on local context processing where resource-constrained devices are employed. Among the prominent proposal on ontology based modeling techniques are SOUPA [33] for pervasive environment and CONON [34] for smart home environment. The figure below illustrates the ontology model of the above case study.

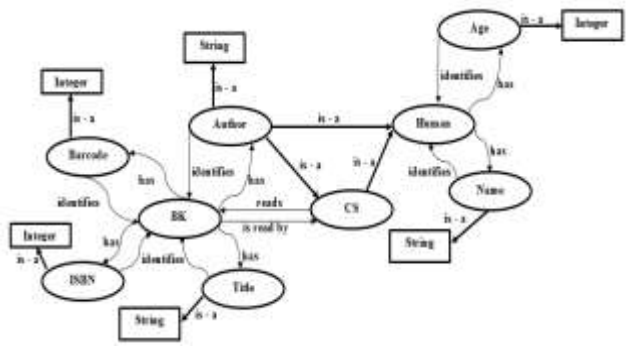


Figure 5: Ontology Model Sample

The ellipses define the basic classes and every arrow defines a relation between these entities. The rectangles are added to show data type values for completion.

OWL-DL is the choice for model context [32] or its variations since it is supported by a number of reasoning services. Web Ontology Language – Description Logic (OWL-DL) allows definition of classes, individuals, characteristics of individuals and relations between various individuals. The figure below illustrates the OWL – DL version for some part of the model.

```
<owl:Class rdf:ID="Human">
    <rdfs:subClassOf rdf:resource="http://www.w3.org/
                2002/07/owl#Thing"/>
</owl:Class>
<owl:DatatypeProperty rdf:ID="age">
    <rdfs:domain rdf:resource="#Human"/>
    <rdfs:range rdf:resource="http://www.w3.org/
                2001/XMLSchema#nonNegativeInteger"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="name">
    <rdfs:domain rdf:resource="#Human"/>
    <rdfs:range rdf:resource="http://www.w3.org/
                2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:Class rdf:ID="CS">
    <rdfs:subClassOf rdf:resource="http://www.w3.org/
                2002/07/owl#Thing"/>
</owl:Class>
<owl:ObjectProperty rdf:ID="reads">
    <rdfs:domain rdf:resource="#CS"/>
    <rdfs:range rdf:resource="#BK"/>
</owl:ObjectProperty>
```

Figure 6: OWL-DL Model Sample

Generally, ontology based models support semantic reasoning, provide an easier representation of context and provide support by standardization. It is however, complex to retrieved data. Also, it can be deduced from the OWL-DL model in Figure 6 that it is inadequate in defining complex context descriptions and thus affects context ontological reasoning.

# 3. BEST CHOICE TECHNIQUE

What is the best technique(s) to use to model activity context? The works of [21] and [35] introduced hybrid approach by combining different modelling techniques to improve performance. Perera et al in [36] surveyed high-level context modelling techniques and concluded that diversification of modelling techniques is the best way to provide efficient results which will lessen each other's weaknesses. Finally, [23] discussed the context modelling techniques and used logic based technique to model spatiotemporal context. They finally concluded that no modelling technique is ideal to be used in a standalone manner. From the above discussion, it is therefore laudable to combine modeling techniques to produce efficient results. Thus the best technique from context acquisition to utilization is hybrid

There are many stages involved in sensing and interpreting context. At each stage, it is better to study the strengths and limitations of each modelling technique and decide the better technique. For example, at the middleware layer, if the abstracted context is to be sent via network, it will not be appropriate to use logic-based modeling, graphical modeling and key-value modeling techniques. However, mark-up and object-based modelling techniques can be used depending on hardware, software and architectural heterogeneity and interoperability between the communicating devices. Similarly, it will be ideal to model context reasoning using the logic-based modeling technique when the application chooses to use the usual if-then rule set mechanisms. Hence the dynamic behaviour of the context-aware system cannot be overlooked when choosing context modeling techniques. The

figure below illustrates the appropriate modeling techniques that can be used at the various modeling stages from which the desired method can be selected.

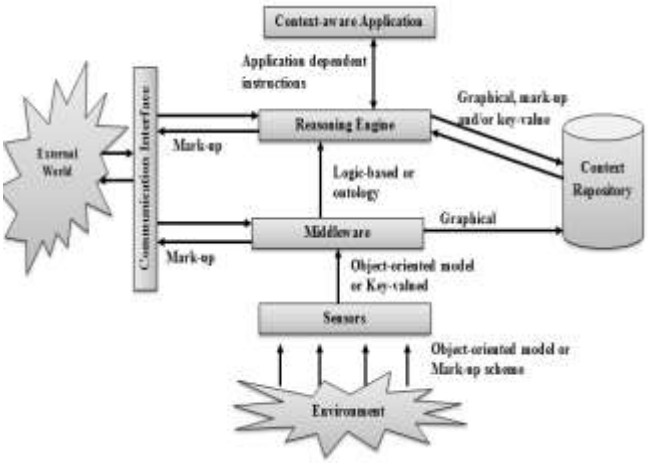


Figure 7 Modeling Implementation of Activity Context Life

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# Textured Enhanced Image De-noising using Fast Wavelet Transform

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**Keywords**: Image Textures; Fast Wavelet Transform; Peak Signal to Noise Ratio; Correlation Factor; Standard Deviation.

## 1. INTRODUCTION

Image Noise models can be classified into two groups. They are $(i)$ Image Independent Noise Model and $(ii)$ Image Dependent Noise Model. Image independent noise can be described by an additive noise model by the equation 1.

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Where $f(i,j)$the processed image or Noisy image is, $s(i,j)$ is the true image without addition of noise and $n(i,j)$ is the additive noise on the true image. Noise $n(i,j)$ is often zero mean and described by its variance$\sigma_n^2$. Signal to Noise Ratio (SNR) is defined as

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In the above equation 2, $\sigma_s^2$ the variance of true image and $\sigma_f^2$ is the variance of processed image. In several cases, white additive noise is evenly distributed over the frequency domain. Where white noise is one of the random signal as shown in Figure 1, having equal intensities at different frequencies and it has a constant power spectral density.

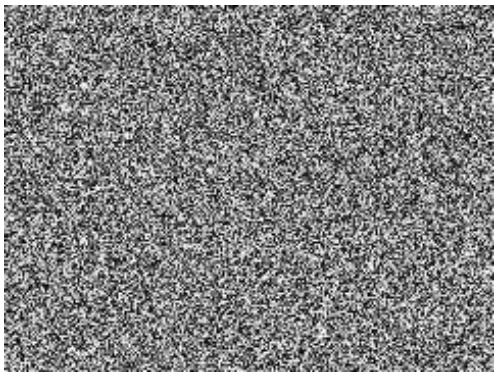


Figure 1. White Noise Image

Data or Image dependent noise model is done with a non linear model or multiplicative model. The image dependent noise models are more complicated, one of the example is an image resulted due to the addition of monochromatic radiation getting scattered from a surface whose irregularities or roughness is of the order of a wavelength which causes interference and it results in speckle noise.

A widespread signal-dependent noise model has been anticipated to deal with numerous diverse acquisition systems. Many types of noise can be described by using the following parametric model equation 3.

$$g(m,n) = f(m,n) + f(m,n)\gamma \cdot u(m,n) + w(m,n) = f(m,n) + v(m,n) + w(m,n) \quad (3)$$

Where $(m,n)$ is the pixel location, $g(m,n)$ the observed noisy image, $f(m,n)$ the noise-free image, modelled as a non-stationary correlated random process, $u(m,n)$ a stationary, zero-mean uncorrelated random process independent of $f(m,n)$ with variance$\sigma 2\ u$, and $w(m,n)$ is electronics noise (zero-mean white and Gaussian, with variance σ2). For a great variety of images, this model has been proven to hold for values of the parameter γ such that$|\gamma| \leq 1$. The additive term $v = f\gamma \cdot u$ is the generalized signal-dependent (GSD) noise. Since 'f' is generally non-stationary, the noise v will be non-stationary as well. The term w is the signal-independent noise component and is generally assumed to be Gaussian distributed. [2]

## 2. PROBLEM STATEMENT

The dilemma of getting better the regression function from noisy data based on wavelet decomposition. To restrain the noise in the data two approaches are normally used. The primary scheme is the called linear method. The wavelet decomposition echo's healthy the properties of the signal in the frequency domain. It is known that the higher decomposition scales related to higher frequency components in the regression function. . If we suppose that the fundamental regression is owed in the low frequency domain then the filtering process becomes evident. All empirical wavelet coefficients ahead of

some resolution scale are anticipated by zero. This modus operandi works well if the signal is adequately smooth and whilst there is no edge effect in the data. But for several practical problems such a loom do not give the impression to be fully apposite, e.g. images cannot be painstaking as smooth functions.

To shun this inadequacy often a nonlinear filtering modus operandi is worn to hold back the noise in the empirical wavelet coefficients. The focal idea is based on the elementary property of the wavelet transform; father and mother functions are sound localized in time domain. Consequently one can estimate the empirical wavelet coefficients independently. To perform this approach compares the standard deviation of the noise and the absolute value of the empirical wavelet coefficient. It is lucid that if the wavelet coefficient is of the same order to that of the noise level, then it is difficult to separate the noise and the signal. In this state of affairs a high-quality estimator for the wavelet coefficient is nil. In the crate after an empirical wavelet coefficient is superior to the noise level a usual estimator for a wavelet coefficient is the empirical wavelet coefficient itself it is called thresholding. Hence divide the diverse adjustments of thresholding in principally three methods: Hard Thresholding, Soft Thresholding and a Levelwise Thresholding using Stein risk estimator.

## 3. LITERATURE SURVEY

The author proposed very effective denoising algorithm based on gradient histogram preservation which shows good PSNR/SSIM value. This approach is very logical working as a comparator circuit of OP-AMP and it work globally for any noisy image mathematically by using adaptive algorithm. This method is not applicable for multiplicative Poisson noise and signal dependent noise [1].

In this method various optical imaging instrument such as CCD (Charge Coupled Device) cameras, multispectral scanners and imaging spectrometers are used to estimate the noise. It depends on multivariate regression such as mean and variance. The method provides good accuracy, SNR and it is robust to the image textures which lead to over estimation of noise [2].

When the data samples are finite or quantized and non-parametric in nature then the noise estimation is done commonly using kernel density estimation where if the data samples are in parametric in nature then it is estimated empirically. Here Gradient Decent and expectation maximum techniques for max. Likelihood optimization is developed and it results in good smooth optimization [3].

In this method the digital image is degraded and restored using non linear filters called histogram adaptive fuzzy filter. The process is carefully checked and compared using other methods like Adaptive fuzzy mean filter, minimum-maximum detector based filter, minimum-maximum exclusive filter and weighted adaptive fuzzy mean. The PSNR is best compared with above methods [4].

Here the author concentrated on image and video signal for denoising the work is done using wavelet thresholding methods for removing various types of noises on the image and video signals. The various parameters like PSNR, correlation factor and MSE are calculated. [5]

## 4. IMAGE DENOISING BLOCK DIAGRAM

In the process of image noising the non linear noise model is used where the noise is added in the channel being used to propagate the image signal. Here uncompressed image of TIFF (Tagged Image File Format) is used for processing the main objective is to remove the noise present on the image which got attacked in the noisy channel. Fast wavelet transforms like haar, db2, db4, db6, db8, Symlet, Cofilet and bi-orthogonal are used to remove the noise from the noisy image. The entire process is shown in the below figure 2.


Figure 2. Image denoising block diagram

### 4.1 Hard Thresholding

To hold back the noise relates the following nonlinear transform to the empirical wavelet coefficients as shown in the equation 4.

$$F(x) = x.I(|x| > t) \quad (4)$$

Where‘t’ is a firm threshold. The selection of the threshold is a very fragile and vital statistical problem. On one hand, a immense threshold guides to a huge bias of the estimator. Nevertheless on the other hand, a tiny threshold increases the variance of the smoother. Hypothetical concern capitulate the threshold as shown in equation 5.

$$t = \sqrt{2\sigma^2 \log(n)/n} \quad (5)$$

Where ‘n’ is the length of the input vector
and $\sigma^2$ is the variance of the noise

### 4.2 Soft Thresholding

The only difference between the hard and the soft thresholding measures are in the choice of the nonlinear transform on the empirical wavelet coefficients. For soft thresholding the following nonlinear transform is used

$$S(x) = sign\,(x)\big(|x| - t\,I(|x| > t)\big) \quad (7)$$

where ‘t’ is a threshold. The set of choices provides you with all possibilities for choosing the threshold and discover the data.

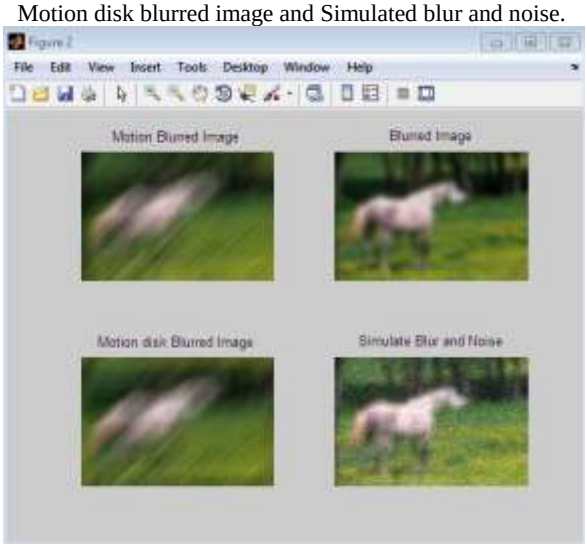
### 4.3 Adaptive Thresholding

Adaptive thresholding using Stein's principle is as follows, We define a risk function $R(s_t, Z_k, t)$ with $Z_k = c_k + s_k e_k, k = 1,2,\ldots M$where $c_k$ is the unknown coefficient, $s_k$ is the scaled parameter, $e_k$ is i.i.d $N(0,1)$ random variable and t the threshold. Stein enables us to estimate the risk $\sum_{k=1}^{M} R(s_k, Z_k, t)$ the risk minimizing argument $\hat{t}$ can also be estimated and will be taken then as the optimal adaptive threshold ‘t’.

$$\hat{t} = \arg\min_{t\geq 0} \sum_{k=1}^{M} \left(2s_k^2 + t^2 - Z_k^2\right) I\{|Z_k| \geq t\} \quad (8)$$

## 5. RESULTS

The objective of image denoising is attained fruitfully with various thresholds. The below figure 3 shows the various noisy images like motion blurred image, blurred image, Motion disk blurred image and Simulated blur and noise.



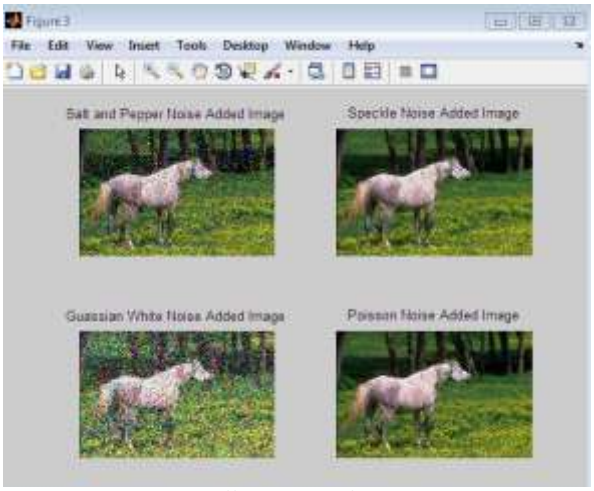




Figure 4. Different kinds of Noisy images

.

In the figure 4 salt and pepper noise, speckle noise, Gaussian white noise and Poisson Noise are added and respective figures are shown above. The PSNR of the results is shown in the below Figure 5.

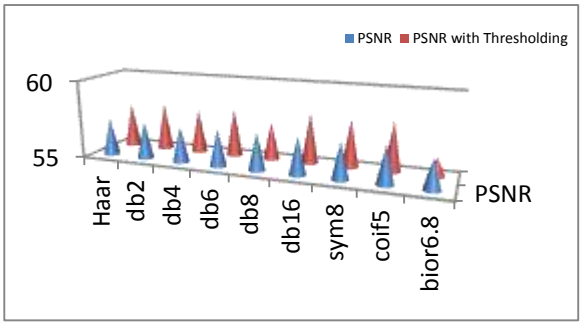



Figure 5. PSNR values without and with adaptive thresholding

Figure 3. Various Blur with Noises


Figure 6. Image processed by db16 wavelet.

The above figure 6 shows the image being processed with db16 wavelet for image denoising with adaptive thresholding method and figure 7, shows the corresponding PSNR values in chart.

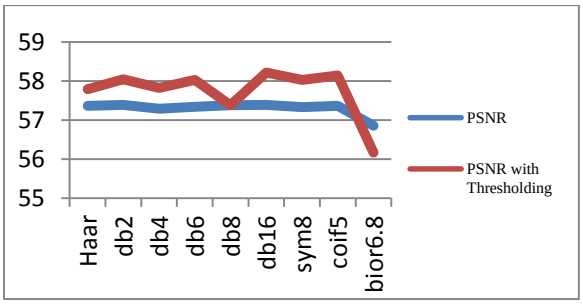



Figure 7. PSNR values of various wavelet transform

## 6. CONCLUSION

In the process of image denoising proper preprossing filter is used where the pre-processing filters are Median filer, Averaging filter, and mean filter. The best method to remove the signal dependent noise is to use wavelets in which the noise is removed in by using adaptive thresholding method. The PSNR value of different wavelets has been observed. The db8 and db16 wavelets are best suited for White Gaussian noise intensities, for speckle noise haar and family of daubechies wavelets can be used. The Best PSNR value is observed is 58.865 for Coiflet transform and daubechies transform with 58.85.

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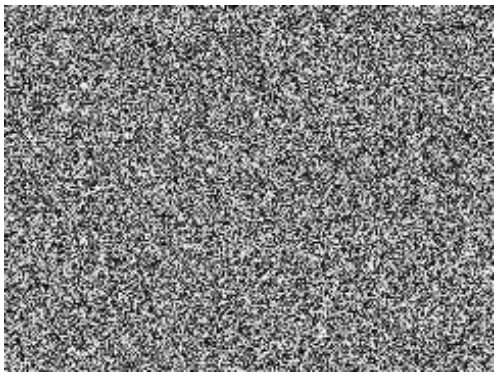

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To shun this inadequacy often a nonlinear filtering modus operandi is worn to hold back the noise in the empirical wavelet coefficients. The focal idea is based on the elementary property of the wavelet transform; father and mother functions are sound localized in time domain. Consequently one can estimate the empirical wavelet coefficients independently. To perform this approach compares the standard deviation of the noise and the absolute value of the empirical wavelet coefficient. It is lucid that if the wavelet coefficient is of the same order to that of the noise level, then it is difficult to separate the noise and the signal. In this state of affairs a high-quality estimator for the wavelet coefficient is nil. In the crate after an empirical wavelet coefficient is superior to the noise level a usual estimator for a wavelet coefficient is the empirical wavelet coefficient itself it is called thresholding. Hence divide the diverse adjustments of thresholding in principally three methods: Hard Thresholding, Soft Thresholding and a Levelwise Thresholding using Stein risk estimator.

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When the data samples are finite or quantized and non-parametric in nature then the noise estimation is done commonly using kernel density estimation where if the data samples are in parametric in nature then it is estimated empirically. Here Gradient Decent and expectation maximum techniques for max. Likelihood optimization is developed and it results in good smooth optimization [3].

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In the process of image noising the non linear noise model is used where the noise is added in the channel being used to propagate the image signal. Here uncompressed image of TIFF (Tagged Image File Format) is used for processing the main objective is to remove the noise present on the image which got attacked in the noisy channel. Fast wavelet transforms like haar, db2, db4, db6, db8, Symlet, Cofilet and bi-orthogonal are used to remove the noise from the noisy image. The entire process is shown in the below figure 2.


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Where ‘n’ is the length of the input vector
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$$\hat{t} = \arg\min_{t\geq 0} \sum_{k=1}^{M} \left(2s_k^2 + t^2 - Z_k^2\right) I\{|Z_k| \geq t\} \quad (8)$$

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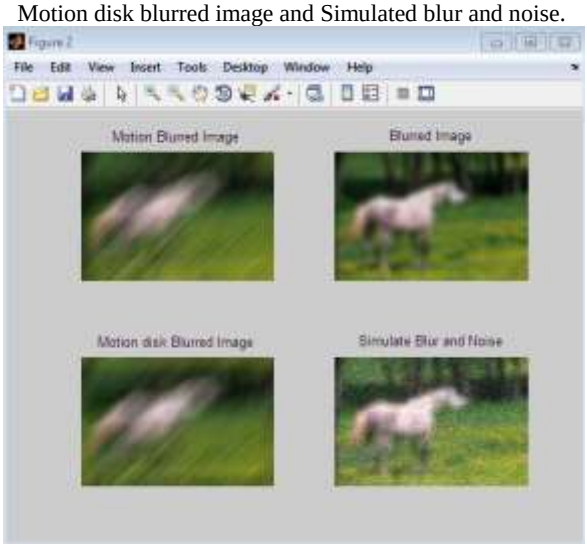
The objective of image denoising is attained fruitfully with various thresholds. The below figure 3 shows the various noisy images like motion blurred image, blurred image, Motion disk blurred image and Simulated blur and noise.



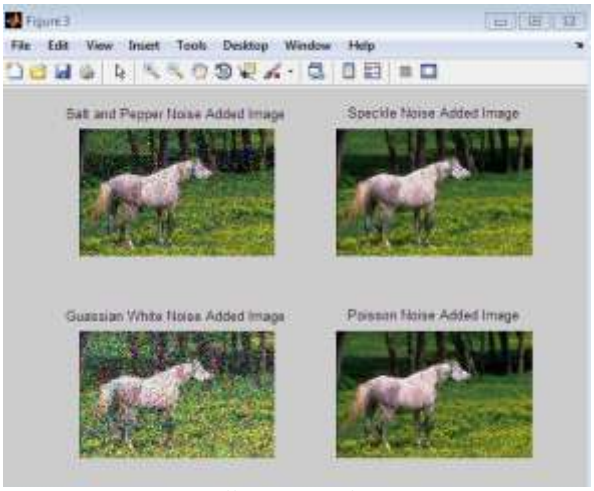




Figure 4. Different kinds of Noisy images

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In the figure 4 salt and pepper noise, speckle noise, Gaussian white noise and Poisson Noise are added and respective figures are shown above. The PSNR of the results is shown in the below Figure 5.

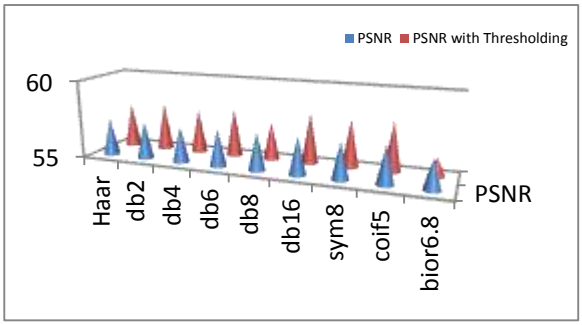


Figure 5. PSNR values without and with adaptive thresholding

Figure 3. Various Blur with Noises


Figure 6. Image processed by db16 wavelet.

The above figure 6 shows the image being processed with db16 wavelet for image denoising with adaptive thresholding method and figure 7, shows the corresponding PSNR values in chart.

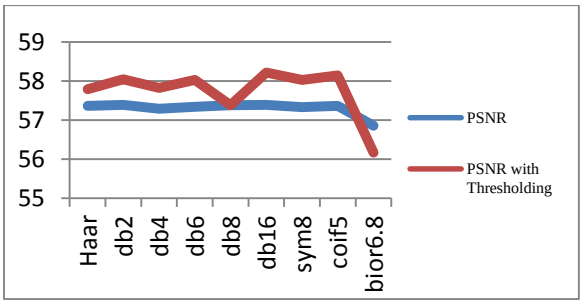


Figure 7. PSNR values of various wavelet transform

## 6. CONCLUSION

In the process of image denoising proper preprossing filter is used where the pre-processing filters are Median filer, Averaging filter, and mean filter. The best method to remove the signal dependent noise is to use wavelets in which the noise is removed in by using adaptive thresholding method. The PSNR value of different wavelets has been observed. The db8 and db16 wavelets are best suited for White Gaussian noise intensities, for speckle noise haar and family of daubechies wavelets can be used. The Best PSNR value is observed is 58.865 for Coiflet transform and daubechies transform with 58.85.

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# Textured Enhanced Image De-noising using Fast Wavelet Transform

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**Abstract**: The digital imaging technologies possess very hasty development that uses Giga-pixels to store an image. Image de-noising algorithms plays a significant role in the restoration process. In an image the texture regions are homogeneous and are composed of local descriptor, a trade off exist between visual quality of image and the enhanced texture regions. In the existing paper the Gradient Histogram Preservation (GHP) method on the enhanced image regions have a limitation where it cannot be directly applied to non-additive noise removal such as Multiplicative Poisson Noise (MPN) and Signal-Dependent Noise (SDN) to overcome the limitation Fast Wavelet Transform is used. In this work an image is first added with different types of noise like Additive White Gaussian Noise (AWGN), Salt and Pepper Noise, Poisson Noise, Signal Dependent noise and Flicker Noise, the noisy image is restored using filters, next the enhanced texture region of the image is chosen which is blurred or deformed and the fine details of the texture is obtained using Fast Wavelet Transform (FWT). The proposed work is analyzed in Frequency domain by considering various parameters like Peak Signal to Noise Ratio (PSNR), Correlation Factor (CF) and Standard Deviation (SD) and the quality of the enhanced region of the image is improved to the best level than the conventional noise removal algorithms.

**Keywords**: Image Textures; Fast Wavelet Transform; Peak Signal to Noise Ratio; Correlation Factor; Standard Deviation.

## 1. INTRODUCTION

Image Noise models can be classified into two groups. They are $(i)$ Image Independent Noise Model and $(ii)$ Image Dependent Noise Model. Image independent noise can be described by an additive noise model by the equation 1.

$$f(i,j) = s(i,j) + n(i,j) \quad (1)$$

Where $f(i,j)$the processed image or Noisy image is, $s(i,j)$ is the true image without addition of noise and $n(i,j)$ is the additive noise on the true image. Noise $n(i,j)$ is often zero mean and described by its variance$\sigma_n^2$. Signal to Noise Ratio (SNR) is defined as

$$SNR = \frac{\sigma_s}{\sigma_n} = \sqrt{\frac{\sigma_f^2}{\sigma_n^2} - 1} \quad (2)$$

In the above equation 2, $\sigma_s^2$ the variance of true image and $\sigma_f^2$ is the variance of processed image. In several cases, white additive noise is evenly distributed over the frequency domain. Where white noise is one of the random signal as shown in Figure 1, having equal intensities at different frequencies and it has a constant power spectral density.

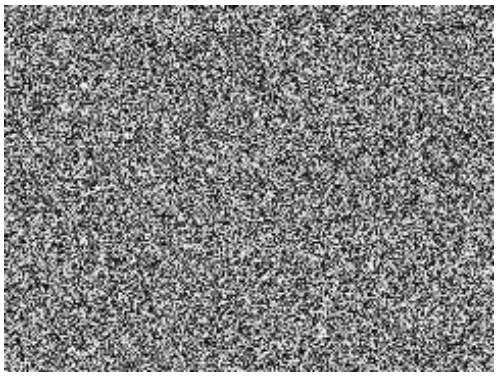

Figure 1. White Noise Image

Data or Image dependent noise model is done with a non linear model or multiplicative model. The image dependent noise models are more complicated, one of the example is an image resulted due to the addition of monochromatic radiation getting scattered from a surface whose irregularities or roughness is of the order of a wavelength which causes interference and it results in speckle noise.

A widespread signal-dependent noise model has been anticipated to deal with numerous diverse acquisition systems. Many types of noise can be described by using the following parametric model equation 3.

$$g(m,n) = f(m,n) + f(m,n)\gamma \cdot u(m,n) + w(m,n) = f(m,n) + v(m,n) + w(m,n) \quad (3)$$

Where $(m,n)$ is the pixel location, $g(m,n)$ the observed noisy image, $f(m,n)$ the noise-free image, modelled as a non-stationary correlated random process, $u(m,n)$ a stationary, zero-mean uncorrelated random process independent of $f(m,n)$ with variance$\sigma 2\ u$, and $w(m,n)$ is electronics noise (zero-mean white and Gaussian, with variance σ2). For a great variety of images, this model has been proven to hold for values of the parameter γ such that$|\gamma| \leq 1$. The additive term $v = f\gamma \cdot u$ is the generalized signal-dependent (GSD) noise. Since 'f' is generally non-stationary, the noise v will be non-stationary as well. The term w is the signal-independent noise component and is generally assumed to be Gaussian distributed. [2]

## 2. PROBLEM STATEMENT

The dilemma of getting better the regression function from noisy data based on wavelet decomposition. To restrain the noise in the data two approaches are normally used. The primary scheme is the called linear method. The wavelet decomposition echo's healthy the properties of the signal in the frequency domain. It is known that the higher decomposition scales related to higher frequency components in the regression function. . If we suppose that the fundamental regression is owed in the low frequency domain then the filtering process becomes evident. All empirical wavelet coefficients ahead of

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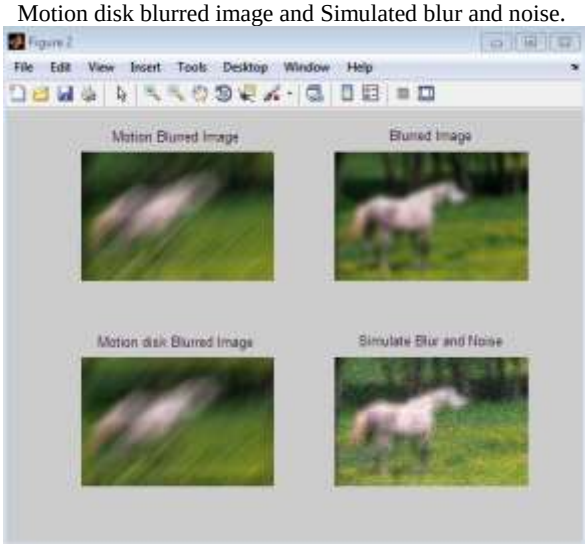


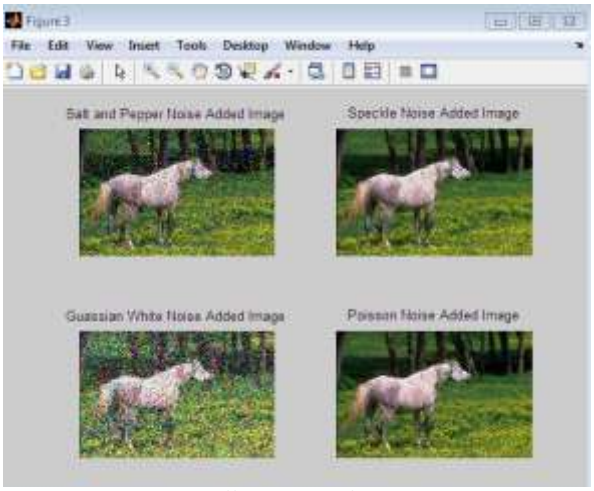


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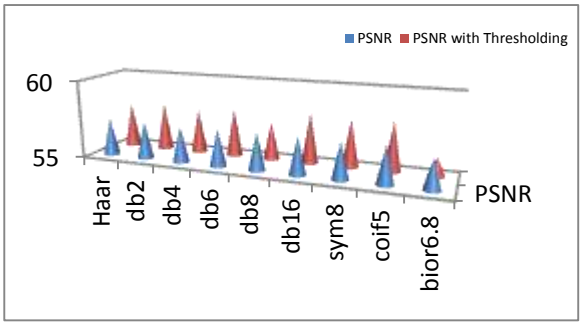


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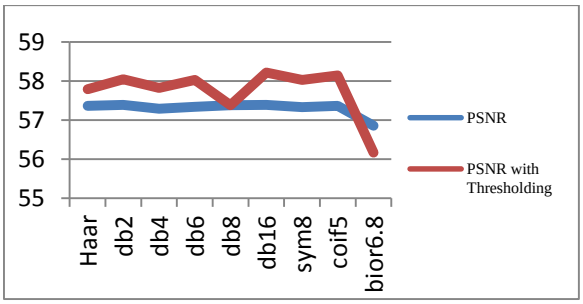


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# Activity Context Modeling in Context-Aware Environment

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**Abstract**: The explosion of mobile devices has fuelled the advancement of pervasive computing to provide personal assistance in this information-driven world. Pervasive computing takes advantage of context-aware computing to track, use and adapt to contextual information. The context that has attracted the attention of many researchers is the activity context. There are six major techniques that are used to model activity context. These techniques are key-value, logic-based, ontology-based, object-oriented, mark-up schemes and graphical. This paper analyses these techniques in detail by describing how each technique is implemented while reviewing their pros and cons. The paper ends with a hybrid modeling method that fits heterogeneous environment while considering the entire of modeling through data acquisition and utilization stages. The modeling stages of activity context are data sensation, data abstraction and reasoning and planning. The work revealed that mark-up schemes and object-oriented are best applicable at the data sensation stage. Key-value and object-oriented techniques fairly support data abstraction stage whereas the logic-based and ontology-based techniques are the ideal techniques for reasoning and planning stage. In a distributed system, mark-up schemes are very useful in data communication over a network and graphical technique should be used when saving context data into database.

**Keywords**: context; context modeling; context-aware computing; hybrid context model; mobile computing; pervasive computing

## 1. INTRODUCTION

With the proliferation of mobile devices, one looks to pervasive computing to provide personal assistance in this digital world. Pervasive computing refers to obtaining available data any time at any place. One critical aspect of pervasive computing is context-aware computing in which applications are made to track, use and adapt to contextual information. The definition of context by Dey and Abowd [1] which is also adopted in this work is, "*Any information that can be used to characterize the situation of an entity. An entity is a person, place or object that is considered relevant to the interaction between a user and an application including the user and application themselves*". The relatively important contexts [2], [3] are location, time, identity and activity. The first three contexts are obtained through well-known mechanisms. The location context can be determined when the device is outdoor through Global Positioning System (GPS) [4] or indoor through radio frequency technologies like Bluetooth [5]. Concerning the time of the day, the clock system of a mobile device can be used in connection with external authenticated system [6]. However, many techniques are employed in tracking activity context. This paper reviews the prominent techniques stating the pros and cons of the various mechanisms. The paper ends with the best approach for activity modeling through the various stages of data acquisition and interpretation.

Context modeling is the process of identifying the appropriate contextual information of interest and establishing relationships and reactions among the pieces of contextual information. Schmohl and Baumgarten in [7] suggested that context modelling requires two phases: the first phase is to determine the conceptual abstraction of real world characteristics. The second phase is to map the concepts on a context model that represent the information. To sense and interpret contextual information, many components are required. The core components are sensors, middleware, context repository, context reasoning and communication interface. Context sensor can be hardware or software that fetches raw data for contextual information. Because the raw data cannot be interpreted by high level languages [8], there is the need for a middleware that refines the raw data from sensors into the required data structures [9]. The context repository stores the current context based on the data structures generated by the middleware. Context reasoning infers new context based on the current context information obtained from the middleware. The context reasoning relies on a set of rules [10] to infer the new context. Communication interface is required in distributed system. Reasoning mechanism may commit contextual updates into a network or may request contextual information through a network. The context reasoning after inference passes the message to the context-aware application which uses the information to adapt itself through the execution or termination of certain programs. A conceptual view of the context utilization mechanism is illustrated below:

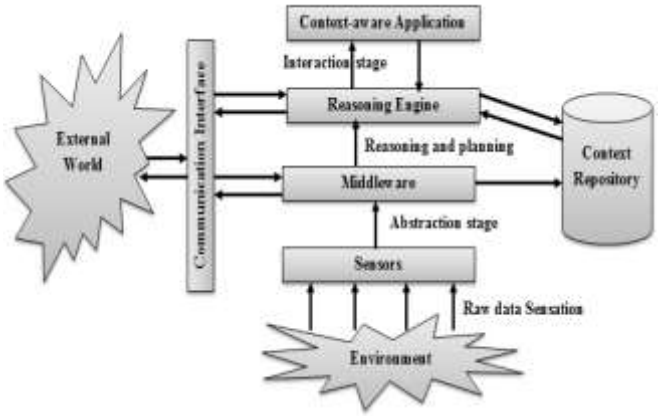


Figure 1 Context Acquisition and Utilization Framework

There are six mechanisms or models that can be used to sense and interpret a context within the various components stated above. These are key-value, mark-up scheme, graphical, object-oriented, logic-based and ontology-based models

## 2. MODELING TECHNIQUES

The six modeling techniques that can be used to model activity context are discussed in details below. To illustrate how each model is implemented, the following case study is model during the discussion of the various techniques. "A computer science book (BK) is read by computer scientist (CS). BK has Title, ISBN; Author, Barcode as its attributes. The title and author are string data type whereas ISBN and Barcode are integer data type. The author is usually computer scientist who of course is a human. Humans are characterized by name and age being string and integer data types respectively."

### 2.1 Key-Value Models

They require simple data structures to associate context attributes with specific values of conceptual information [7]. Schilit et al in [11] used key-value pairs to model the context by assigning the value of context information to an environment variable in an application. From the case study above, the characteristics of the entities – BK and CS – which form the keywords for the modeling are:

- **BK**: title, ISBN, author, barcode
- **CS**: name, age

Since human and CS are the same in terms of characteristics, human is ignored in the modeling. The characteristics that can be used to identify BK are ISBN and barcode. Both features are of integer data types, though barcode are sometimes alphanumeric. This work restricts itself to only numeric barcodes. It is therefore not applicable to alphanumeric barcodes. There is other integer feature called age that belongs to CS. However, the length of age should not be more than three. Barcode has varying length but usually more than three. Similarly, the length of ISBN is more than three. Hence, every set of data consisting of numeric characters with length greater than 3, is associated with BK. The other features of BK are author and title. They cannot be used in our model since author and title consist of set of characters similar to the features of CS. Thus to avoid ambiguity, author and title are ignored. Similarly, the name feature of CS is also ignored. Regarding CS, the characteristics the can be used to identify CA is the age. Thus if the data is integer with length less than or equal to three, then CS is being referenced. The figure below gives the key-value model for the above case study

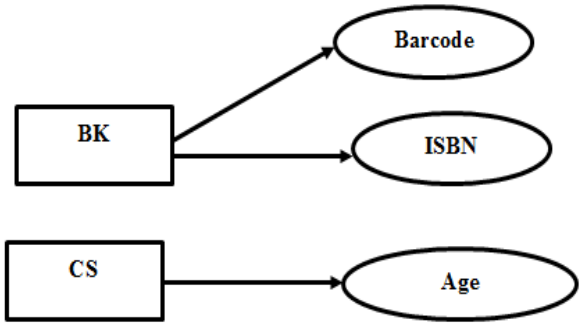


Figure 2 Key-Value Sample Model

There is no relationship established between BK and CS as discussed above. The characteristics provided should be followed closely so that entities can be identified and reasoning inferred. It can be deduced that key-value model is flexible and easy to manage in a small system. However, the model limits the amount of data. The model is also application dependent and is not adaptive. There is no validation support and relationship modeling.

### 2.2 Mark-up scheme models

They used hierarchical data structures based on mark-up tags with attributes and comments. It is based on serialization of Standard Generic Mark-up Language (SGML), the superclass of all mark-up languages. Among the commonly used mark-up schemes are eXensible Mark-up Language (XML) and Resource Description Framework (RDF). XML is used to package data or information and RDF is used for conceptual description or modelling in web resources using a data serialization format. The above case study is designed using XML. XML file cannot contain multiple root elements. Thus each root element – BK, CS and Human – are contained in separate files. In the figure below, only section of BK is implemented.

```
1  <?xml version="1.0" encoding="utf-8" ?>
2      <CSBooks>
3          <BK>
4              <title>some data</title>
5              <author>some data</author>
6              <isbn>some data</isbn>
7              <barcode>some data</barcode>
8          </BK>
9          <BK>
10             .
11             .
12             .
13         </BK>
14         .
15         .
16         .
17     </CSBook>
18
```

Figure 3 Mark-up Sample Model

Some researchers extended RDF capabilities to Composite Capabilities/Preferences Profile (CC/PP) [12] and User Agent Profile (UAProf) [13] which allow the definition and preferences in context delivery. For instance, in [14] and [15], the researchers designed Comprehensive Structured Context Profile (CSCP) and CC/PP Context Extension respectively to handle the limitation of CC/PP. The limitation of CC/PP is that it allows specific values only. Another context modelling approach which does not follow CC/PP is the pervasive Profile Description Language (PPDL) [16]. This is an XML-based language for designing interaction patterns on limited scales. In order to reduce bandwidth consumption, XML can be combined with JavaScript Object Notation (JSON) [17] which reduces the transmission time of context-aware applications. JSON is lightweight data exchange format that allows computers to generate and parse data easily and faster. Mark-up schemes are flexible and structured. There are available tools for processing and very useful when data is travelled along a network or communication link. Unfortunately, mark-up schemes depend on the application and information is hard to extract.

### 2.3 Graphical models

They represent contextual entities and their relationships graphically using tools like Uniform Modelling Language (UML) and Entity Relationships (ER) schemas. UML is very

expressive since it uses directed graph to indicate the relationships between concepts. However, it is difficult to work with UML [18] due to its increasing complexity. As of 2016, there are more than fourteen different diagrams making it virtually impossible for developers to recognize. ER on the other hand describes conceptual pieces as entities and the interactions as relationships. The major limitation of ER is the lack of semantics between the entities due to limited representation of relationships, data manipulation, constraints and specifications between entities. The above case study is modeled using ER. The entities in the case study are CS, BK and Human

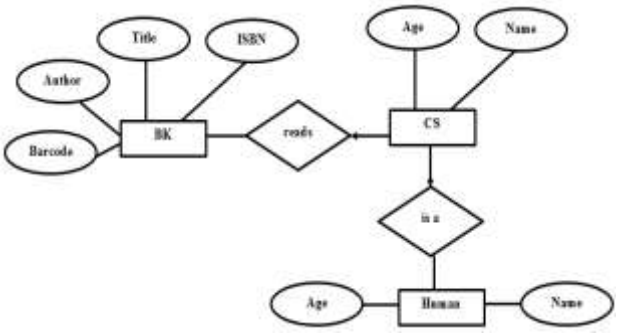


Figure 4 Sample Entity Relations Graphical Model

To handle the limitations of ER, extensions are provided by researchers through the additions of extra features in context modeling. Bauer in [19] used UML extensions to model air traffic management system. Another type of graphical model is the Object-Role Model (ORM) [20] which is a conceptual level modelling method to handle the semantics of data and its interrelationship among the data. ORM models concepts as facts [21]. The work in [22] extended ORM by employing contextual classification and description properties which introduced history fact to cover time aspect of the context and fact dependencies. Thus a change in one fact automatically leads to a change in another fact. According to Mohan and Singh in [21], formal semantics of ORM and Context Modeling Language (CML) can be supplemented to provide integration with other implementations. Graphical modeling technique as its strength provides relationship modeling, flexible implementation and it is very useful for data storage and historic context store [23]. However, the limitations of graphical modelling technique include its complexity to retrieve information which requires obligatory configuration. It does not support interoperability between heterogeneous implementations.

## 2.4 Object-Oriented Models

They employ the use of object-oriented characteristics such as encapsulation and reusability. Encapsulation hides the implementation of objects whiles reusability allows models to be reused. The Active Object Model of the GUIDE project in [24] was based on object-oriented model. In object-oriented model, entities are modeled using classes which are implemented as objects. The attributes are implemented as data fields or variable in object-oriented model whereas entity behaviors are modeled as methods (in Java) or functions (in C++). The above case study is modeled using Java in the figure below.

```
public class BK{
    private String title;
    private String author;
    private int isbn;
    private int barcode;

    //other methods and fields
    .
    .
    .
}

public class CS extends Human{
    //other methods and fields
}

public class Human{
    //other methods and fields
}
```

Figure 5 Object-Oriented Sample Model

The object-oriented model provides relationship modeling. The tools for processing are available and it allows every integration whiles supporting data transformation over network or communication link. It is however, limited by its complexity to retrieve information.

## 2.5 Logic-based Models

They use rules and expressions to define a context. Logics are used to define conditions for formulating expressions or facts. It is best used at the reasoning section of a context-aware application. The first logic based context modelling approach occurred in 1993 by McCarthy [25] and refined in 1997 [26]. The refined work introduced abstract mathematical entities complemented with useful properties in artificial intelligence which allowed simple axioms to be used in common sense phenomena. Akram and Surav in [27] tried to give theoretical semantic model of natural language in a formal logic system. Many researchers had focused on first order logic in their implementations. Gray and Salber in [28] used it to represent contextual propositions and relations. In [29], first order logic was used in connection with Boolean algebra to design middleware infrastructure called Gaia which allowed various rules to describe context information. It was used in [30] to describe context information properties and structure and the kinds of operations they can perform. Another application is to use logic based model with other modelling techniques. Gu et al in [31] proposed Service-Oriented Context-Aware Middleware (SOCAM) architecture for building context-aware services. In their model, first-order predicate calculus was used to model a context and used different modeling techniques, ontology based model written in Web Ontology Language (OWL) as a collection of RDF triples, to describe the context predicate. Using the first order logic, the following model can be obtained from the above case study:

$\forall x$, (is-isbn(x) $\vee$ is-barcode(x) => BK (x))

$\forall x$, ($\forall y$ (is-name(x) $\wedge$ is-age(y) => CS (x,y)))

$\forall x$, (is-CS(x) => is-Human (x))

$\forall x$, (is-BK(x) => ¬ is-CS (x))

$\forall x$, (is-BK(x) => ¬ is-Human (x))

$\exists x$ , ($\forall y$ ((is-author(x) ∧ is-title(x)) ∨ ¬ is-age (y)) => BK(x,y))).

The above first order logic can also be described using fuzzy logic. The figure below illustrates the fuzzy logic representation.

```
if (data set is isbn) or (data set is barcode) then
    data set represents BK
else if (data set is name) and (data set is age) then
    data set represents CS
    data set also represents Human
end if
```

Figure 6 Fuzzy Logic Sample Model

The strengths of logic-based model are that it generates high-level context based on low-level context. It is simple to use and simple to model. Its limitation is the complication of its applicability. It is also difficult to maintain due to partial validation

## 2.6 Ontology-based Models

Ontologies are used to represent concepts and their interrelationships. This model enables contextual knowledge sharing and reusability [7]. Ontologies are the most expressive context representation models [8] that support dynamic aspects of context awareness. However, they require ontology engines which have high requirements on resources producing negative performance impact on local context processing where resource-constrained devices are employed. Among the prominent proposal on ontology based modeling techniques are SOUPA [33] for pervasive environment and CONON [34] for smart home environment. The figure below illustrates the ontology model of the above case study.

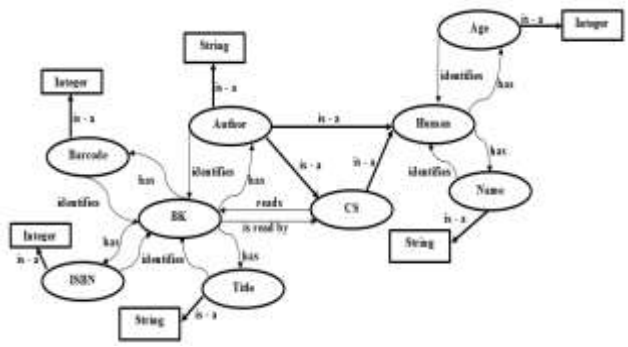


Figure 5: Ontology Model Sample

The ellipses define the basic classes and every arrow defines a relation between these entities. The rectangles are added to show data type values for completion.

OWL-DL is the choice for model context [32] or its variations since it is supported by a number of reasoning services. Web Ontology Language – Description Logic (OWL-DL) allows definition of classes, individuals, characteristics of individuals and relations between various individuals. The figure below illustrates the OWL – DL version for some part of the model.

```
<owl:Class rdf:ID="Human">
    <rdfs:subClassOf rdf:resource="http://www.w3.org/
                2002/07/owl#Thing"/>
</owl:Class>
<owl:DatatypeProperty rdf:ID="age">
    <rdfs:domain rdf:resource="#Human"/>
    <rdfs:range rdf:resource="http://www.w3.org/
                2001/XMLSchema#nonNegativeInteger"/>
</owl:DatatypeProperty>
<owl:DatatypeProperty rdf:ID="name">
    <rdfs:domain rdf:resource="#Human"/>
    <rdfs:range rdf:resource="http://www.w3.org/
                2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<owl:Class rdf:ID="CS">
    <rdfs:subClassOf rdf:resource="http://www.w3.org/
                2002/07/owl#Thing"/>
</owl:Class>
<owl:ObjectProperty rdf:ID="reads">
    <rdfs:domain rdf:resource="#CS"/>
    <rdfs:range rdf:resource="#BK"/>
</owl:ObjectProperty>
```

Figure 6: OWL-DL Model Sample

Generally, ontology based models support semantic reasoning, provide an easier representation of context and provide support by standardization. It is however, complex to retrieved data. Also, it can be deduced from the OWL-DL model in Figure 6 that it is inadequate in defining complex context descriptions and thus affects context ontological reasoning.

# 3. BEST CHOICE TECHNIQUE

What is the best technique(s) to use to model activity context? The works of [21] and [35] introduced hybrid approach by combining different modelling techniques to improve performance. Perera et al in [36] surveyed high-level context modelling techniques and concluded that diversification of modelling techniques is the best way to provide efficient results which will lessen each other's weaknesses. Finally, [23] discussed the context modelling techniques and used logic based technique to model spatiotemporal context. They finally concluded that no modelling technique is ideal to be used in a standalone manner. From the above discussion, it is therefore laudable to combine modeling techniques to produce efficient results. Thus the best technique from context acquisition to utilization is hybrid

There are many stages involved in sensing and interpreting context. At each stage, it is better to study the strengths and limitations of each modelling technique and decide the better technique. For example, at the middleware layer, if the abstracted context is to be sent via network, it will not be appropriate to use logic-based modeling, graphical modeling and key-value modeling techniques. However, mark-up and object-based modelling techniques can be used depending on hardware, software and architectural heterogeneity and interoperability between the communicating devices. Similarly, it will be ideal to model context reasoning using the logic-based modeling technique when the application chooses to use the usual if-then rule set mechanisms. Hence the dynamic behaviour of the context-aware system cannot be overlooked when choosing context modeling techniques. The

figure below illustrates the appropriate modeling techniques that can be used at the various modeling stages from which the desired method can be selected.

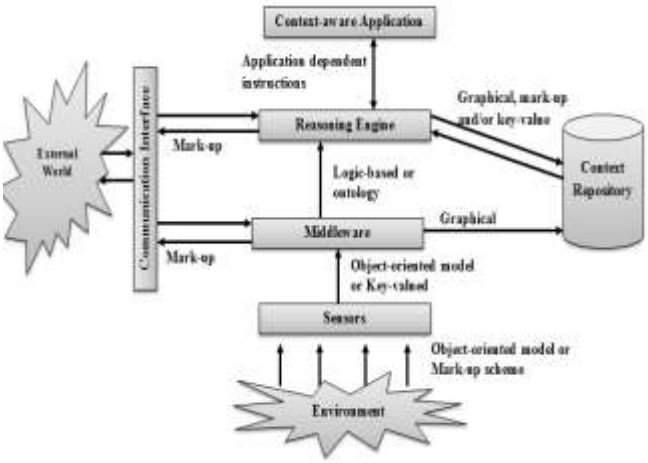


Figure 7 Modeling Implementation of Activity Context Life

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# Gesture Based Retrieval for Mental Illness Recognition

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**Abstract***:* In this work, we try to explore and explain content based image retrieval technique for mental illness early detection based on gesture expression. Gesture expression based to recognize mental illness due to gesture has multidimensional and may features for calculation. A technique used to detect and recognize facial expression called Content Based Image Retrieval or CBIR, in this technique needed gesture image training and referencing. This research also proposed to construct an accurate method or algorithm to detect and recognize whether one's suffers mental illness or not. In this research was carried out using gesture image database and gesture without obstacles (hat, moustache, glasses, etc). Research uses more than 5,000 gesture images with gesture which collected from Lampung mental illness hospital and from the internet. Research produce an image gesture retrieval result quite good in term of precession and recall parameters.

**Keywords**: Image retrieval, gesture detection, mental illness, gesture recognition

## 1. INTRODUCTION

Since hand gesture on the head can represents one's emotional expression and our behavior, so gesture and head considered as unique human characteristics. Human's expertise to recognize face and hand gestures can be easily done even though face expression influenced by age, obstacles (glasses, hat, hijab, and hair style). However, in face and gesture detection accurately ,particularly for absolutely new faces are very complicated due to some factors such as: recognition, expression analysis, and feature based classification [1]. There are two possibilties task in recognition namely: i. Image matching MATCH of uknow person, ii. VERIFICATION as representavives of one's identification, the system include verification and image checking for small database.Hand and face recognition technique development is very complicated since face considered multidimention and changes according the environment and situation.

Therefore, an automation of face and h and position recognition is a challenge to most researchers, recently. Some changes of face condition such as face identity and face variation happened due to lightening and different angel of shooting become an obstacle to predict how to interprets face expression in mental illness recognition. This issue considered a challenge for researches to explain one's mental condition based on hand and face recognition.

Mental illness or mental disorder caused by ancestry, age, sex, physical condition, culture, habit, beliefs, trust, marriage, pregnancy, lost of love ones, agresion, feelling guilty, and animosity [7]. According to WHO, around 450 million people currently suffer from such conditions, placing mental disorders among the leading causes of ill-health and disability worldwide, recently.

A suitable method needed to detect one's mental condiotion in order mental illness early detection and unexpected tragedy can be avoided. An application or tool is urgently needed to help he/she to recognize as early as possible his/her family whether suffer mentall illness or not. Tool also can be used by a medical doctor and psychiatrist to help to detect their mental patient condition. Expression of face and hand position is an intial activity and fundamental of recording geometric space to differentciate certain expression features. According to [2] DSM-IV-TR(*Diagnostic and Statistical Manual of Mental Illness, 4th edition with text revision*) there are some mentall ilness, such as: psychotic mental ilness, neuro mentall ilness , functional mentall illness,organic mentall ilness,primer ilness, and secondary mentall illness.

In this paper, the work tried to detect all kind of kind of mentall illness mentioned previuosly. Mentioned by [7] , a mental illness is a health problem that significantly affects how a person feels, thinks, behaves, and interacts with other people. It is diagnosed according to standardized criteria. The term mental disorder is also used to refer to these health problems. A mental health problem also interferes with how a person thinks, feels, and behaves, but to a lesser extent than a mental illness. Mental health problems are more common and include the mental ill health that can be experienced temporarily as a reaction to the stresses of life. Mental health problems are less severe than mental illnesses, but may develop into a mental illness if they are not effectively dealt with. Mental illnesses cause a great deal of suffering to those experiencing them, as well as their families and friends. Furthermore, these problems appear to be increasing. According to the World Health

Organization, depression will be one of the biggest health problems worldwide by the year 2020.

The research proposed to find method as well as automatic tools or application to predict one's mental condition such as happy, sad ,and under pressure based on hand and face position. Recently, many negative actions happened such as suicide, and criminal begins from mentall illness. Mental health and mental illnesses are determined by multiple and interacting social, psychological, and biological factors, just as health and illness in general. The clearest evidence for this relates to the risk of mental illnesses, which in the developed and developing world is associated with indicators of poverty, including low levels of education, and in some studies with poor housing and low income. The greater vulnerability of disadvantaged people in each community to mental illnesses may be explained by such factors as the experience of insecurity and hopelessness, rapid social change, and the risks of violence and physical ill-health.

As mentioned before Mental health is more than the mere lack of mental disorders. The positive dimension of mental health is stressed in WHO's definition of health as contained in its constitution: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. "Concepts of mental health include subjective well-being, perceived self-efficacy, autonomy, competence, intergenerational dependence and recognition of the ability to realize one's intellectual and emotional potential. It has also been defined as a state of well-being whereby individuals recognize their abilities, are able to cope with the normal stresses of life, work productively and fruitfully, and make a contribution to their communities. Mental health is about enhancing competencies of individuals and communities and enabling them to achieve their self-determined goals. Mental health should be a concern for all of us, rather than only for those who suffer from a mental disorder. Mental health problems affect society as a whole, and not just a small, isolated segment. They are therefore a major challenge to global development. No group is immune to mental disorders, but the risk is higher among the poor, homeless, the unemployed, persons with low education, victims of violence, migrants and refugees, indigenous populations, children and adolescents, abused women and the neglected elderly

The researh proposed to build tool or application in order to detect one's mental condition. The tool expexted has capability to recognize one's mental illness and help the community or medical doctor to recognize one's mental condition based face expression and gesture.

A semantics-sensitive method to content-based image retrieval has been proposed in [8]. A semantic categorization (e.g., graph - photograph, textured - nontextured) for appropriate feature extraction followed by a region based overall similarity measure, allows robust image matching.

A significant feature of this system is its retrieval speed. The matching measure, interm of region matching has been constructed for faster retrieval using region feature clustering and the most similar highest priority rinciple [98]. Region based image retrieval has also been extended to integrate spatial similarity using the Hausdorff distance on finite sized point sets[10] ]Whilst approaches to Retrieval Once a decision on the visual feature has been made, how to navigate them towards accurate image retrieval.There has been a large number of fundamentally different frameworks proposed in the last few years [11].

A framework for region-based image retrieval using region codebooks and learned region weights has been proposed in [12]. A new representation for object retrieval in cluttered images without relying on accurate segmentation has been proposed in [13]. Additional perspective in image retrieval has been region-based querying using homogeneous color texture segments called blobs, instead of image to image matching [14].

For example, if one or more segmented blobs are identified by the user as roughly corresponding to the concept "tiger", then her search can comprise of looking for a tiger within other images, possibly with varying backgrounds. While this can lead to a semantically more precise representation of the user's query objects in general, it also requires greater involvement from and dependence on her. For finding images containing scaled or translated versions of query objects, retrieval can also be performed without the user's explicit region labeling [15].

A hybrid method had been in troduced by [16] , in this mehod they use of rectangular blocks for coarse foreground/background segmentation on the user's query region-of-interest (ROI), followed by the database search using only the foreground regions. Whilts, for segmentation is not critical.

Instead of using image segmentation, one approach to retrieval has been the use of hierarchical perceptual grouping of primitive image features and their inter-relationships to characterize structure [17]. Another proposition has been the use of vector quantization (VQ) on image blocks to generate codebooks for representation and retrieval, taking inspiration from data compression and text-based strategies [18].

Alternative wavelet-based retrieval method involving salient points has been proposed in [19]. Fractal block code based image histograms have been shown effective in retrieval on textured image databases [20]. The use of the MPEG-7 content descriptors to train self-organizing maps (SOM) for the purpose of image retrieval has been explored in [21]. Among other new approaches, anchoring-based image retrieval system has been proposed in [22]. Anchoring is based on the fairly intuitive idea of finding a set of representative "anchor" images and deciding semantic proximity between an arbitrary image pair in terms of their similarity to these anchors. Despite the reduced computational complexity,

the relative image distance function is not guaranteed to be a metric. With the similar reasons, a number of methods have relied on the assumption that the image feature space is a manifold embedded in Euclidean space [23- 25].

Clustering has been applied to image retrieval to help improve interface design, visualization, and result pre-processing [26-28]. A statistical approach involving the Wald-Wolfowitz test for comparing non-parametric multivariate distributions has been used for color image retrieval, representing images as sets of vectors in the RGB-space. A number of probabilistic frameworks for image retrieval have been proposed in the last few years [29,30]. Further more they proposed to integrate feature selection, feature representation, and similarity measure into a combined Bayesian formulation, with the objective of minimizing the probability of retrieval error. One problem with this approach is the computational complexity involved in estimating probabilistic similarity measures. Using VQ to approximately model the probability distribution of the image features, the complexity is reduced [99],so making the measures more practical for the real-world systems.

**2.1 Content Based Image Retrieval and JPEG.**

Content-based image retrieval (CBIR) is a low-level based features based retrieval simply based on the content or existing image [1]. Some content-based image retrieval have been done up to this time, including: Blobworld [2], the system PicToSeek [31], C-BIRD [32], and MARS system [33]. Meanwhile International standard compression has now been widely introduced and is known as JPEG and MPEG. JPEG image has been very popular as a ISO / ITU-T standard and is patented in the 1990s, some models have been defined by the JPEG [34] including the baseline model, lossless, progressive and hierarchical. Algorithm of digital image compression can be explained as follows (Wallace, 1991):

- Original pixel divided into blocks with 8 x 8 dimensions , which amounts to 64 pixels where each pixel value is shifted from unsigned integers in the range [0, $2^p$-1] to a signed integer in the range [-$2^p$-1, $2^p$- 1]
- Then every pixel within the block (Bi) are processed through the 2D Discrete Cosine Transform function and produce DCT blocks (Bi *), and every single DC coefficient (which is the average intensity of all the blocks) and AC coefficients of the number 63 on each block, can be formulated as follows:

$$F(u,v)=\frac{1}{4}\sum_{x=0}^{7}\sum_{y=0}^{7}C(u)C(v)f(k,y)\left[\cos\left(\frac{(2x+1)u\pi}{16}\right)\cos\left(\frac{(2y+1)v\pi}{16}\right)\right]$$

where: u, v vary in accordance with the direction of columns and rows, C (u), C (v) = for u, v = 0.

- After that quantizes done on a 64 coefficient is by using the following equation:

$$FQ=\text{int}\,Round\frac{F(u,v)}{Q(u,v)}$$

- Implementation of a zig-zag order and then the coefficient of each block in quantizes Application of entropy code on each coefficient either with Huffman or arithmetic.

**2.2 Image Searching.**

Traditional image searching and retrieval were carried out based on query-by-example (QBE) starting from the input image into the system (query image) are compared to the existing image in the database, several studies have been made by researchers, among them [8]. In face image based retrieval, they stated that standard query image can be a mental image. Furthermore they said that their research focus on face features, moreover all the algorithms developed can be applied to other domains, for example in clothing, home furnishings, and paintings, and mental face images. One example of effective mental image searching has been stated by Cox [9].

Image searching in the DC domain by using many methods have been done previously and provide satisfactory and effective results compare to image searching in the pixel domain [10]. As has been proven that with a certain level of compression, then search the face to give even better results than a search on the DC domain.

**2.3 Face recognition**

Although many automatic face recognition techniques are successfully applied in many areas of daily life, but the task of face recognition based only on the scale bias. Research topic in face recognition is still a challenge, especially in the uncontrolled environment (Adini, et.al., 1997). Meanwhile, to match with face image that is in the database or gallery we use the Euclidean distance calculation, if Euclidean distance equal to zero then the image will be exactly the same query image is in the database.

Face recognition can be done by using the chromatic color components, Hue and Saturation as was done by Zhao in Petrou (Petrou and Bosdogianni, 2005). Face can be considered as unique features ofuman, even twins their faces still different although they are very similar. Human epertise to recgnize a face can be done easily even if face's appearences influenced by its expression, age, and obstacles (glasess, hat, hijab).

Since face is the window or form part of the body that describes the emotions and circumstances of our lives. Face can be considered as unique features of human, even twins they are will remain distinct even though his face looks exactly the same. Human expertise to recognize faces can be done easily influenced by even the appearance of face expression, age, and obstructions such as glasses or hairstyle changes. However, to detect

faces with appropriate especially for faces in a completely new is not easy and there are many issues relating to the above, these problems include: detection of a model's face, recognition, analysis face expressions, and classification based on physical features (Samal and Iyengar, 1992).

## 2. METHOD

### 2.1. Ground Truth

In this researh more then 5,000 face and gesture, images colleted for mental hospital and internet,we use face with normal pose or forward facing 90 degree . Face and hand position recognotion in this work we used conten based image retrieval [4,5]. We used also Pricinple Component Analysis (PCA) and Bayesian Clasifier to detect face region. We extract number of face graph salient geometric in order to represent color and shape features as well as face countour and texture vector normalized by shape.

### 2.2 Hand and position pattern engineering

When query by example step done, then in order to find similirity we usedn eiganfaces calculation , the calculation carried out to extract vector features use to clasifify and recognize face expression. Simplicity, eigenfaces has some procedure such as : i). We assume that face image trainning (training set images) are $I_1$,$I_2$,$I_3$, ... $I_n$, where each image has I(x,y) dimension, then each image converted to vector with (mxn) matrix , and m is number image training while p is equal p x y. ii). Compute mean of face matrix;iii). Compute each mean of matrix;iv). To reduce number of matrix vector , do matrix transormation; v). compute eigenvector and eigenvalues, so each image has own matrix region;vi). Finally, re-engineer face image into vector and previous vector.

Face Recognition, after formulizing the representation of each face, the last step is to recognize the identities of these faces. In order to achieve automatic recognition, a face database is required to build. For each person, several images are taken and their features are extracted and stored in the database. Then when an input face image comes in, we perform face detection and feature extraction, and compare its feature to each face class stored in the database. There have been many researches and algorithms pro-posed to deal with this classification problem, and we'll discuss them in later sections. There are two general applications of face recognition, one is called identification and another one is called verification. Face identification means given a face image, we want the system to tell who he / she is or the most probable identification; while in face verification, given a face image and a gusture of the identification, we want the system to tell true or false about the gesture. The steps of face detection can describes as follow :

*Input face edge image*
*Extract of mouth block set candidate*
*For i = 1 to N*
*Extract of face region candidate*
*Calculate face score*
*If i<=N then i=i+1*
*Else*
*Select mounth block with maximum face score*
*Eye location*
*Extraction of face orienation*
*End*
*Face region*

### 2.3. Gesture recognitionn and detection

Main of gesture detection function is to determine whether human's face is exist in the image and where the face position exist. The expected output from this gesture recognition is face region and to make gesture recognition more accurate as well as easier to design gesture recognition, gesture alignment need to carried out in order to justify face region. Further more, pre-processing need to done also to do gesture detection to determine *region-of-interest* atau ROI.

After gesture detection step, human's face region extracted from the image. By using face region for gesture recognition, there some disadvantages such as: i). Each region usually has more than 1.000 pixels which mean to big to build an accurat and robust gesture recognition; ii). Face region taken from different angle with different gesture recognition . In oder to solve this problem , feture extarction needed to carried out to reduce dimension, salience extraction, and noise cleaning.

Finally, after calculating each region , the last step to be caried out is recognition and indentification this face region. Sequently, automatic recognition needs to bulid face image database. For each person, some images needed to be taken and feature extracted then save into database. When, face image input into system in this step gesture detection and feature extraction, then the features compared to face feature in the database. There two applications in gesture recognition, firstly identification and secondly verification. Gesture indentification used to recognize one's identified whilts gesture verification to determine whether one's face correctly indetified or wrongly indetified.

### 2.4. Maching similarity to detect mental disorder

When compute similarity between geture query and face image citra in the database carried out directly need high cost in term complex algorithm and takes time in processing. To overcome from this problem, this work was carried out in three steps to match face image and gesture. The steps are : i). Find similarity between face and hand position topology query and face image in the database which is considered as filter; ii). Information used to improve image candidate retrieved, and iii). Apply matching calculation in or order to determine image similarity between image query and face and gesture in the database. In this work used face with normal pose.

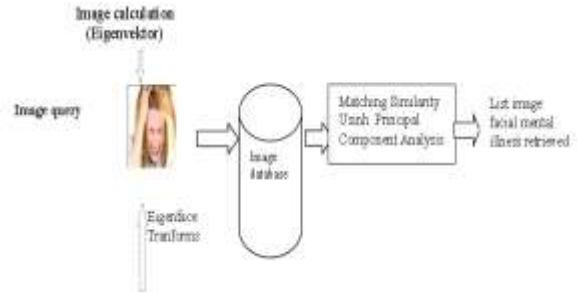


Fig 1. Matching face gesture

## 3. RESULT AND DISCUSSION

### 3.1. Retrieval effectiveness

Our work demonstrates that average precission of face retrieval more than 70 % with the highest of 1 and the lowes precision is 15 %. From this results we can say that our algorithm quite good to retrieve face with mental illness. In this work, we used 80 queries with around 5,000 face image database which consisit of 200 normal face image and 4,800 face with face image with mentall illness.

In our algorithm we used RGB image as a query which then convert to YcbCr and HVS components, more detail the algoritm can be described as followed:

1. *Face and gesture image query*
2. *Convert RGB image into YcbCr and HVS components*
3. *Statistic feature extraction by computing the Eigenfaces*
4. *Compute matrix average*
5. *Compute covanriance of matrix C by using the following formula*

$$C = \frac{1}{M}\sum_{n-1}^{M}\Phi_n\Phi_n^T$$

6. *Compute eigenvector and eigenvalue of matrix*
7. *Choose face principles component*
8. *Compute the similarity or image matching by using Euclidean Distance*

$$d(x_i, x_j) = \sqrt{\sum_{r=1}^{n}(a_r(x_i) - a_r(x_j))^2}$$

9. *Sort or rank image retrieved based on euclidean distance*

   *for number of block = 1 to N*
   *for u=0 to 63*
   *for v=0 to 63*
   *D(Iq(u,v), Id(u,v))*
   *end*
   *end*
   *end*

10. *Show or display the most 20 similar images*
11. *For nex query repeat step 1 to 8*

**Table 1. Effectivity of image retrieval**

| Query | Precision | Recall |
|---|---|---|
| 1 | 0,15 | 0,01 |
| 2 | 0,15 | 0,02 |
| 3 | 0,21 | 0,03 |
| 4 | 0,22 | 0,04 |
| 5 | 0,22 | 0,05 |
| ..... | ..... | ..... |
| ..... | ..... | ..... |
| 71 | 1 | 0,04 |
| 77 | 0,94 | 0,04 |
| 78 | 0,94 | 0,05 |
| 79 | 0,95 | 0,01 |
| 80 | 0,95 | 0,02 |
| Average : | 0,748272 | 0,030988 |
| Highest : | 1 | 0,09 |
| Lowest : | 0,15 | 0,01 |

In this work , we used more than 5.000 face image with gesture which suffer mental gesture suspected andaroun 1.000 normal face images. From 40 queries applied shows the effectiveness of image retrieval as 60% and 1,3 % in term of precission and recall. From the 40 queries also show the highest precission is 100% and the lowest is 10%, more detail of this results can be examined in figure 2.

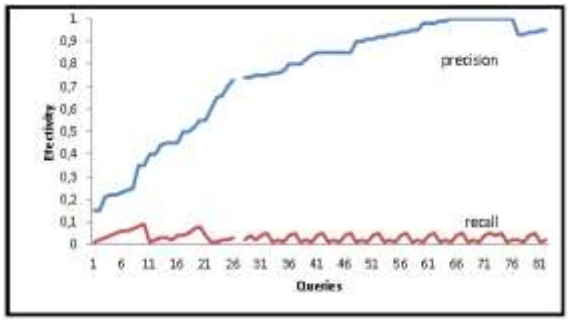


Fig. 2. The Retrieval effectivity in term of Precision and Recall

## 4. DISCUSSION

The result of this work shows that our algorithm demonstrate good effectiveness in term of Precission and recall. The precission of image retrieval shows aroun 60 % , it means that the face recognition algorithm used in this work quite good and simple, but demonstrate good performance. From the reslt.

## 5. FUTURE WORKS

Existing and future research needs to be worked to improve the effectiveness of the algorithm by using larger database both in terms of both quantity and variety. We will try to apply other methods such as segmentation, neural network, and fuzzy logic.

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# A Few Improvements for Selection Sort Algorithm

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**Abstract :**

Sorting refers to arranging data in a particular format. In this paper three modifications for the selection sort algorithm are presented. The modifications are mainly based on the programming methodologies used. In the first algorithm smallest and biggest element are found out in a single loop and exchanging first element with the smallest and last element with the biggest. This is repeated for all the elements. In the second algorithm first smallest and second smallest element are found out in a single loop and these values are moved as the first two elements. This is repeated for the rest of the elements. In the third algorithm first biggest and second biggest element are found out in a single loop and these are carried to the last positions. This is repeated for the remaining elements. The advantages of the modifications are then analyzed.

**Keywords:** Selection Sort, Algorithm, Comparison, Exchange

## 1. INTRODUCTION

Ordering the data in an increasing or decreasing fashion according to some data item is called sorting. Selection sort is a simple sorting algorithm. Smallest element is selected from the unsorted array and swapped with the leftmost element and that element becomes part of sorted array. This process continues moving unsorted array boundary by one element to the right. The average and worst case complexity are of O(n2) where n are no. of items.

## 2. RELATED WORK

[1] Both ended Sorting Algorithm. The algorithm comprises of two phases, in first phase, one element from the front end and one element from rear end are compared. If the front element is greater than rear element, then swap the elements. In the second phase, two consecutive elements from the front are taken and compared. Replacing is done if required.

[2] Improving the performance of Selection sort. The algorithm is developed by finding the smallest element in the data list and replacing with first element is done in one loop and finding the largest element in the data list and replacing with last element is done in another loop.

## 3. SELECTION SORT

Selection sort is a simple sorting algorithm. In this sorting algorithm the list is divided into two parts, sorted part at left end and unsorted part at right end. Initially sorted part is empty and unsorted part is entire list. Smallest element is selected from the unsorted array and swapped with the leftmost element and that element becomes part of sorted array.

### 3.1 Algorithm

Procedure Selection_Sort(K,N)

1. [Loop on Pass Index]
   Repeat thru step 4 for Pass = 1,2,...,N-1
2. [Initialize Minimum Index]
   MIN_INDEX ← Pass
3. [Make a Pass and obtain smallest element]
   Repeat for I = Pass+1, Pass+2,..., N
   If K[I] < K[MIN_INDEX]
   then MIN_INDEX ← I
4. [Exchange elements]
   If MIN_INDEX ≠ Pass
   then K[Pass] ‹—› K[MIN_INDEX]
5. [Finished]
   Return

This process continues moving unsorted array boundary by one element to the right. This algorithm is not suitable for large data sets as its average and worst case complexity are of O(n2) where n are no. of items.

### 3.2 Pseudo Code

```
for (i = 0; i < count - 1; i++)
{
        minimum = i;
       for (j = i + 1; j < count; j++)
{
        if (data[minimum] > data[j])
        {
                minimum = j;
        }
}
 swap data[i] and data[minimum]
}
```

## 4. FIRST SMALLEST FIRST BIGGEST

This algorithm finds the first smallest and the first biggest element in a single loop and exchanging first element with the smallest and last element with the biggest. This is repeated with other elements.

### 4.1 Algorithm

Procedure Sort1(K,N)

1. [ Loop on Pass Index]
   Repeat thru step 5 for Pass = 1,2,...N
2. [Initialize Minimum & Maximum Index]
   MIN_INDEX ← K[Pass]
   MAX_INDEX ← K[N]
3.[Make a Pass and obtain Smallest and Biggest element]
   Repeat for I = Pass+1, Pass+2....N
   If MIN_INDEX > K[I]
   then MIN_INDEX ← K[I]
   POS1 ← I
   If MAX_INDEX < K[I]
   then MAX_INDEX ← K[I]
   POS2 ← I
4. [Exchange elements]
   K[Pass] ‹—› POS1
   K[N] ‹—› POS2
5. [Decrement N]
   N ← N-1
6. [Finished]
   Return

### 4.2 Pseudo Code

```
for (p=1;p<=n;++p)
{
        s = a[p], b = a[n];
        for(j=p;j<=n;++j)
        {
                if (s > a[j])
                {       s = a[j];
                        x = j;
                }
                else if (b < a[j])
                {
                        b = a[j];
                        y = j;
                }
Swap elements in position x and y with first and last element
n = n-1;
}
```

### 4.3 Working

This algorithm first finds the smallest as well as biggest number in a single loop. Once the smallest number is found, its position in the list is stored in the variable x, simultaneously the position of the biggest number is stored in variable y. Swap the first element and the element in position x and also swap the last element with the element in position y. The above process is continued until all the elements are attained its position. The loop process is done in n/2 times where n is the total no. of data elements in the list.

## 5. FIRST SMALLEST SECOND SMALLEST

This algorithm finds the first smallest and the second smallest element in a single loop and exchanging first element with the first smallest and the second element with the second smallest element.

### 5.1 Algorithm

Procedure Sort2(K,N)

1. [ Loop on Pass Index]
   Repeat thru step 4 for Pass = 1,2,...N
2. [Initialize First & Second Smallest Index]
   SMALL1 ← K[Pass]
   SMALL2 ← K[Pass+1]
3.[Make a Pass and obtain First Smallest and Second Smallest element]
   Repeat for I = Pass+1, Pass+2....N
   If SMALL1 > K[I]
   then SMALL2 ← SMALL1
   SMALL1 ← K[ I]
   POS1 ← I
   ElseIf SMALL2 < K[I]
   then SMALL2 ← K[I]
   POS2 ← I
4. [Exchange elements]
   K[Pass] ‹—› POS1
   K[Pass+1] ‹—› POS2
5. [Finished]
   Return

### 5.2 Pseudo Code

```
for (p=1;p<=n;++p)
{
    small1=a[p]; small2 = a[p+1];
    for(j=p+1;j<=n;++j)
    {
        if (small1 > a[j])
        {
            small2 = small1;
            small1 = a[j];
            y = x;
            x = j;
        }
        else if (small2 > a[j])
        {       small2 = a[j];
                y = j;
        }
    }
    Swap elements in position x & y with p and p+1
    ++p;
}
```

### 5.3 Working

This algorithm first finds the first smallest as well as second smallest numbers in a single loop. Once the first smallest number is found, its position in the list is stored in the variable x, simultaneously the position of the second smallest number is stored in variable y. Swap the first element and the element in position x and also swap the second element with the element in position y. The above process is continued until all the elements are attained its position. The loop process is done in n/2 times where n is the total no. of data elements in the list.

## 6. FIRST BIGGEST SECOND BIGGEST

This algorithm finds the first biggest and the second biggest element in a single loop and exchanging the first element with the first biggest and the second element with the second biggest.

### 6.1 Algorithm

Procedure Sort3(K,N)

1. [ Loop on Pass Index]
   Repeat thru step 4 for Pass = 1,2,...N
2. [Initialize First & Second Biggest Index]
   BIG1 ← K[Pass]
   BIG2 ← K[Pass+1]
3.[Make a Pass and obtain First Biggest and Second Biggest element]
   Repeat for I = Pass+1, Pass+2....N
   If BIG1 > K[I]
   then BIG2 ← BIG1
   BIG1 ← K[ I]
   POS1 ← I
   ElseIf BIG2 < K[I]
   then BIG2 ← K[I]
   POS2 ← I
4. [Exchange elements]
   K[Pass] ‹—› POS1
   K[Pass+1] ‹—› POS2
5. [Finished]
   Return

### 6.2 Pseudo Code

```
for (p=1;p<=n;++p)
{
    x = 0; y = 0; big1= a[p]; big2 = a[p+1];
    for(j=p+1;j<=n;++j)
    {
        if (big1 < a[j])
        {       big2 = big1;
                big1 = a[j];
                y = x;
                x = j;
        }
        else if (big2 < a[j])
        {       big2 = a[j];
                y = j;
        }
    }
    Swap elements in position x & y with p and p+1
    ++p;
}
```

### 6.3 Working

This algorithm first finds the first biggest as well as second biggest numbers in a single loop. Once the first biggest number is found, its position in the list is stored in the variable x, simultaneously the position of the second biggest number is stored in variable y. Swap the first element and the element in position x and also swap the second element with the element in position y. The above process is continued until all the elements are attained its position. The loop process is done in n/2 times where n is the total no. of data elements in the list.

## 7. COMPARISON

### 7.1 Comparison Table

| No. of Elements | A | B | C | D |
|---|---|---|---|---|
| 50 | 1275 | 1236 | 1180 | 1177 |
| 100 | 5050 | 5027 | 4834 | 4810 |
| 150 | 11325 | 11257 | 10986 | 10985 |
| 200 | 20100 | 19959 | 19591 | 19618 |
| 300 | 45150 | 44896 | 44386 | 44320 |

A → Selection Sort
B → First Smallest First Biggest
C → First Smallest Second Smallest
D → First Biggest Second Biggest

Above programs were executed with sample input data of 50, 100, 150, 200, 300 and no. of comparisons ( IF conditions ) are calculated.

## 8. CONCLUSION

From the comparisons table it is found that the new algorithms (First Smallest & First Biggest, First Smallest & Second Smallest, First Biggest & Second Biggest) the no. of comparisons made is lesser than the no. of comparisons made in selection sort.

## 9. REFERENCES

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