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# The Significance of Real-time, Biomedical and Satellite Image Processing in Understanding the objects & Application to Computer Vision

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*Abstract* - **The Computer Vision is a broader and hottest area of Digital Image Processing with lot of past, ongoing and future research to accomplish the mission of providing visual sense to computers as like human visual system in understanding, processing, classifying, manipulating, and recalling images based on their category. This Paper focus on providing a clear route map in describing the importance of understanding Biomedical, satellite and Real-time photographic Images in application to Computer Vision. The aim of the current research is to Proposes a detailed study on techniques and algorithms proposed by previous researchers and to derive a best and hybrid method that can process all the different category of images and manipulate them for computers to understand the objects clearly as like humans do with the help of supervised/unsupervised algorithms by applying AI techniques.**

**The initial part of the work focus on pre-processing of the raw image for the colours present, dimension present in it. After pre-processing, the features such as edges present are extracted and based on the edges, the shapes present are extracted from the input image and later part of the work focus on categorizing the images based on the feature information present. The same images are subjected to classification process based on creating a knowledge base of sample dataset of images for differentiation whether it is a real-time or satellite or medical image based on the objects and features present in it,**

**The Techniques applied includes Harris Corner Detection algorithm for manipulating the edges and MCMC (Markov chain Monte Carlo) Algorithm is applied in categorizing the shape patterns present in the image. Hybrid SVM is applied for classification of images based on object features such as humans, vehicles, plants, animals etc. present in the training dataset. The Proposed research yields higher significance in Classifying images based on objects for understanding images in computer vision and image processing Application**

***Keywords— Digital Image Processing, Computer Vision, Biomedical Images, Satellite Image, Real-time Photographic Images, Image Processing Application.***

## I. INTRODUCTION

An Image is a two dimensional function F(x, y), where x and y are the spatial coordinates and the amplitude of F at any pair of coordinates(x, y) is called the intensity of the image at that level. When x, y and the amplitude values of F are finite and discrete quantities, then image is called digital image. A Digital image is composed of finite number of elements called pixels, each of which has a particular location and intensity value. Digital image processing is that the use of laptop algorithms to perform image process on digital pictures. As a subcategory or field of digital signal process, digital image process has several blessings over analogue image process. It permits a far wider vary of algorithms to be applied to the computer file and may avoid issues like the build-up of noise and signal distortion throughout process. Since pictures are outlined over 2 dimensions digital image process is also model within the type of dimensional systems.

Image processing may be a technique to convert a picture into digital kind and perform some operations on that, so as to induce associate degree increased image or to extract some helpful info from it. It's a sort of signal dispensation within which input is image, like video frame or photograph and output could also be image or characteristics related to that image. Sometimes Image processing system includes treating pictures as two dimensional signals whereas applying already set signal process ways to them. It is among speedily growing technologies nowadays, with its applications in numerous aspects of a business. Image process forms core analysis space inside engineering and technology disciplines too.

Image processing essentially includes the subsequent 3 steps.

- Commercialism the image with optical scanner or by photography.
- Analysing and manipulating the image which has information compression and image sweetening and recognizing patterns that aren't to human eyes like satellite images.
- Output is that the last stage within which result are often altered image or report that's supported image analysis.

There are two sorts of strategies used for image process specifically, analogue and digital image process. Analogue image processes are often used for the exhausting copies like

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printouts and images. Image analysts use numerous fundamentals of interpretation whereas victimisation these visual techniques. Digital image process techniques facilitate in manipulation of the digital pictures by victimisation computers. The general phases that everyone sorts of knowledge need to bear whereas victimisation digital technique are pre-processing, sweetening, and show, data extraction.

## II. BACKGROUND STUDY

In General Image processing is explained with the following diagram, The diagram does not imply that every process is applied to an image. Rather, the intention is to convey an idea of all the methodologies that can be applied to images for different purposes and possibly with different objectives.

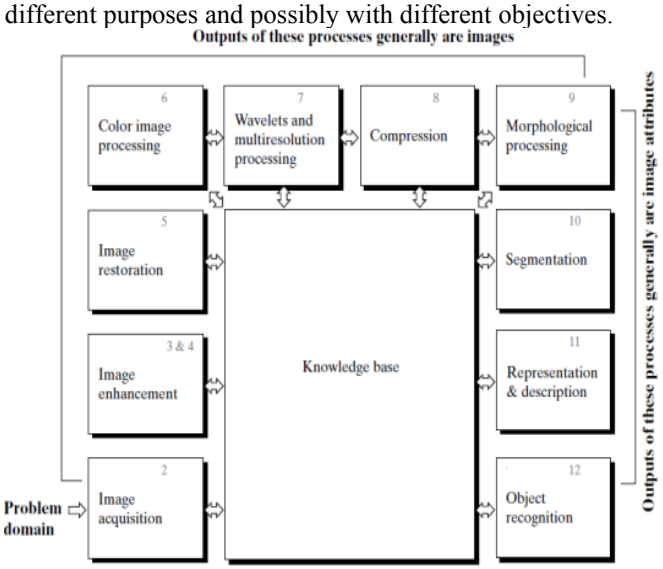



**Fig 1 : Digital Image Processing**

**2.1 Image acquisition** is that the initial method shown in Fig. 1. The analysis gave some hints concerning the origin of digital pictures . wherever we tend to additionally introduce variety of basic digital image ideas that area unit used throughout the book. Note that acquisition can be as straightforward as being given a picture that's already in digital kind. Generally, the image acquisition stage involves pre-processing, like scaling.

**2.2 Image Enhancement** is among the only and most appealing areas of digital image process. Basically, the concept behind improvement techniques is to bring out detail that's obscured, or just to spotlight bound options of interest in a picture. a well-recognized example of improvement is once we increase the distinction
of a picture as a result of "it appearance higher." it's vital to stay in mind that improvement may be a terribly subjective space of image process. area unit dedicated to improvement, not as a result of it's additional vital than alternative topics lined within the book however as a result of we tend to use improvement as AN avenue to introduce the reader to techniques that area unit utilized in other chapters additionally. Thus, instead of having a chapter dedicated to mathematical preliminaries, we tend to introduce variety of required mathematical ideas by showing however they apply to improvement. This approach permits the reader to achieve familiarity with these ideas within the context of image process.

**2.3 Image restoration** is a vicinity that additionally deals with up the looks of a picture. However, in contrast to improvement, that is subjective, image restoration is objective, within the sense that restoration techniques tend to be supported mathematical or probabilistic models of image degradation. improvement, on the opposite hand, is predicated on human subjective preferences concerning what constitutes a "good" improvement result.

**2.4 Colour image process** is a vicinity that has been gaining in importance owing to the numerous increase within the use of digital pictures over the net. topic covers variety of basic ideas in colour models and basic colour process in an exceedingly digital domain. Colour is employed additionally in later chapters because the basis for extracting options of interest in a picture.

Wavelets area unit the inspiration for representing pictures in varied degrees of resolution. specially, this material is employed during this book for image information compression and for pyramidal illustration, during which pictures area unit divided in turn into smaller regions.

**2.5 Compression,** because the name implies, deals with techniques for reducing the storage needed to avoid wasting a picture, or the information measure needed to transmit it. though storage technology has improved considerably over the past decade, a similar cannot be aforesaid for transmission capability. this can be true notably in uses of the net, that area unit characterised by vital pictorial content.

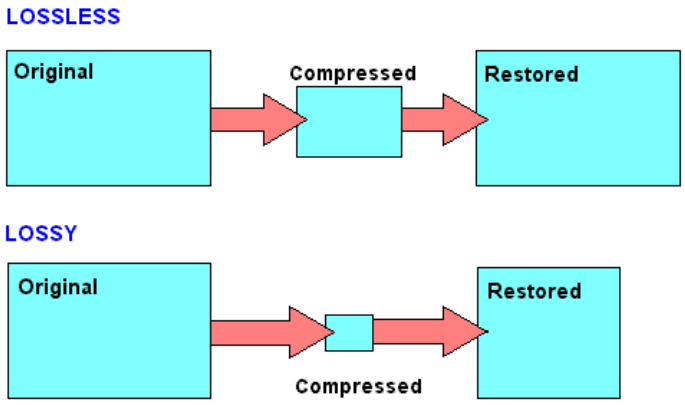



**Fig 2 : Image Compression**

compression is acquainted (perhaps inadvertently) to most users of computers within the variety of image file extensions, like the jpg file extension utilized in the JPEG (Joint Photographic specialists Group) compression commonplace.

**2.6 Morphological process** deals with tools for extracting image parts that area unit helpful within the illustration and outline of form. The fabric during this chapter begins a transition from processes that output pictures to processes that output image attributes**.**

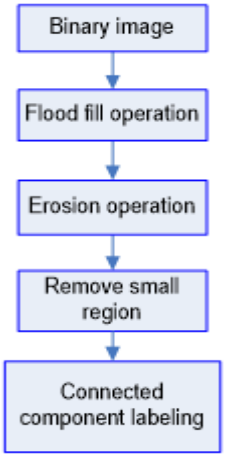



**Fig 3 : Morphological Process**

**2.7 Segmentation** procedures partition a picture into its constituent components or objects. In general, autonomous segmentation is one amongst the foremost troublesome tasks in digital image process. A rugged segmentation procedure brings the method an extended manner toward booming resolution of imaging issues that need objects to be known separately. On the opposite hand, weak or erratic segmentation algorithms nearly always guarantee ultimate failure. In general, the additional correct the segmentation, the additional seemingly recognition is to succeed.

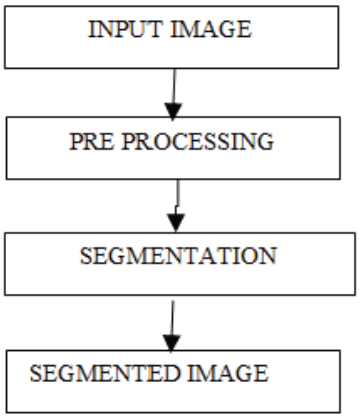



**Fig 4 : Image Segmentation**

**2.8 Representation** and outline nearly always follow the output of a segmentation stage, that typically is raw pixel information, constituting either the boundary of a locality (i.e., the set of pixels separating one image region from another) or all the points within the region itself. In either case, changing the info to a kind appropriate for laptop process is critical. the primary call that has got to be created is whether or not the info ought to be depicted as a boundary or as an entire region. Boundary illustration is suitable once the main target is on external form characteristics, like corners and inflections. Regional illustration is suitable once the main target is on internal properties, like texture or skeletal form. In some applications, these representations complement one another. Selecting a illustration is merely a part of the answer for remodelling information into a kind appropriate for resultant laptop process. a technique should even be such as for describing the info so options of interest area unit highlighted.

Description additionally referred to as feature choice, deals with extracting attributes that end in some quantitative data of interest or area unit basic for differentiating one category of objects from another.

**2.9 Recognition** is that the method that assigns a label (e.g., "vehicle") to AN object supported its descriptors. The analysis conclude our coverage of digital image process with the event of ways for recognition of individual objects.

Character Recognition, Signature Recognition, Biometric fingerprint and Face Recognition, Object Recognition, Human Classification are few recognition based systems in image processing and pattern Analysis Approaches

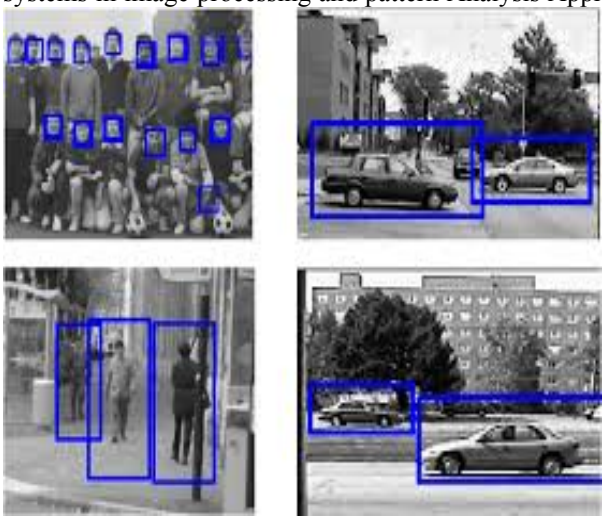


**Fig 5 : Object Recognition**

The knowledge base and the processing modules in Fig.5 Knowledge about a problem domain is coded into an image processing system in the form of a knowledge database. This knowledge may be as simple as detailing regions of an image where the information of interest is known to be located, thus limiting the search that has to be conducted in seeking that information. The knowledge base also can be quite complex, such as an interrelated list of all major possible defects in a materials inspection problem .

**2.10 Medical Imaging**

Biomedical image processing has experienced dramatic expansion, and has been an interdisciplinary research field attracting expertise from applied mathematics, computer sciences, engineering, statistics, physics, biology and medicine. Computer-aided diagnostic processing has already

become an important part of clinical routine.

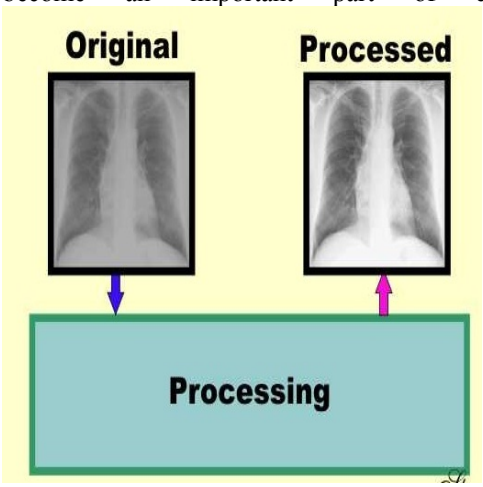



**Fig 6 : Medical Image Processing**

Accompanied by a rush of new development of high technology and use of various imaging modalities, more challenges arise; for example, how to process and analyse a significant volume of images so that high quality information can be produced for disease diagnoses and treatment. The principal objectives of this course are to provide an introduction to basic concepts and techniques for medical image processing and to promote interests for further study and research in medical imaging processing

### 2.11 Satellite Imaging

Previous Research have been focusing on analysis of remotely sensed images. These Images are represented in digital form. When represented as numbers, brightness can be added, subtracted, multiplied, divided and, in general, subjected to statistical manipulations that are not possible if an image is presented only as a photograph. Previously, digital remote sensing data could be analysed only at specialized remote sensing laboratories.

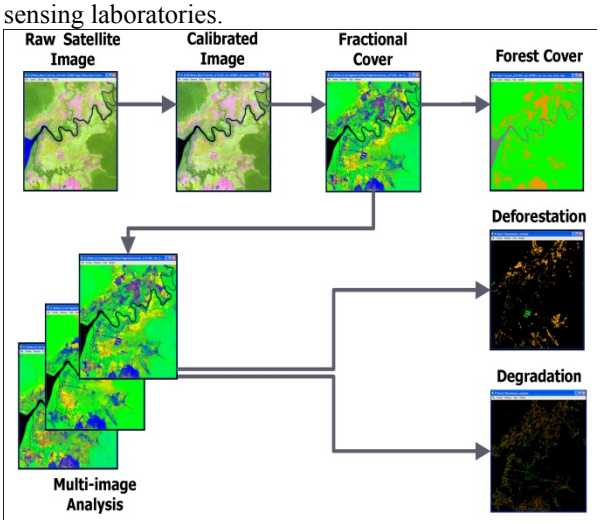



**Fig 7 : Satellite Image Processing**

Specialized equipment and trained Personnel necessary to conduct routine machine analysis of data were not widely available, in part because of limited availability of digital remote sensing data and a lack of appreciation of their qualities.

## III. Methodology

### 3.1 Harris Corner Detection algorithm handling the edges

A corner can be defined as the intersection of two edges. A corner can also be defined as a point for which there are two dominant and different edge directions in a local neighborhood of the point. An interest point is a point in an image which has a well-defined position and can be robustly detected. This means that an interest point can be a corner but it can also be, for example, an isolated point of local intensity maximum or minimum, line endings, or a point on a curve where the curvature is locally maximal.

In practice, most so-called corner detection methods detect interest points in general, and in fact, the term "corner" and "interest point" are used more or less interchangeably through the literature. As a consequence, if only corners are to be detected it is necessary to do a local analysis of detected interest points to determine which of these are real corners. Examples of edge detection that can be used with post-processing to detect corners are the Kirsch operator and the Frei-Chen masking set. "Corner", "interest point" and "feature" are used interchangeably in literature, confusing the issue. Specifically, there are several blob detectors that can be referred to as "interest point operators", but which are sometimes erroneously referred to as "corner detectors". Moreover, there exists a notion of ridge detection to capture the presence of elongated objects. Corner detectors are not usually very robust and often require large redundancies introduced to prevent the effect of individual errors from dominating the recognition task.

One determination of the quality of a corner detector is its ability to detect the same corner in multiple similar images, under conditions of different lighting, translation, rotation and other transforms. A simple approach to corner detection in images is using correlation, but this gets very computationally expensive and suboptimal. An alternative approach used frequently is based on a method proposed by Harris and Stephens (below), which in turn is an improvement of a method by Moravec. Harris and Stephens improved upon Moravec's corner detector by considering the differential of the corner score with respect to direction directly, instead of using shifted patches. (This corner score is often referred to as autocorrelation, since the term is used in the paper in which this detector is described. However, the mathematics in the paper clearly indicate that the sum of squared differences is used.) Without loss of generality, we will assume a grayscale 2-dimensional image is used. Let this image be given by $I$. Consider taking an image patch over the area $(u, v)$ and

shifting it by $(x, y)$. The weighted sum of squared differences (SSD) between these two patches, denoted $S$,

The function iterates to find the sub-pixel accurate location of corners or radial saddle points, as shown on the figure below.

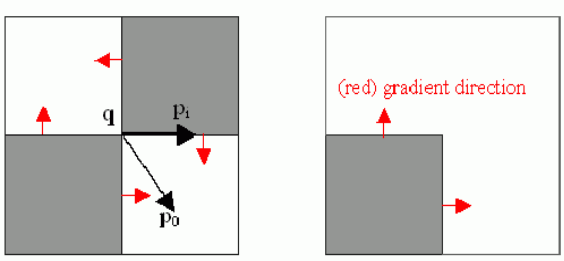



**Fig 8: Sub-Pixel Processing**

Sub-pixel accurate corner locator is based on the observation that every vector from the center $q$ to a point $p$ located within a neighborhood of $q$ is orthogonal to the image gradient at $p$ subject to image and measurement noise. Consider the expression:

$$\epsilon_i = DI_{p_i}{}^T \cdot (q - p_i)$$

where $DI_{p_i}$ is an image gradient at one of the points $p_i$ in a neighborhood of $q$. The value of $q$ is to be found so that $\epsilon_i$ is minimized. A system of equations may be set up with $\epsilon_i$ set to zero:

$$\sum_i (DI_{p_i} \cdot DI_{p_i}{}' j) - \sum_i (DI_{p_i} \cdot DI_{p_i}{}' \cdot p_i)$$

where the gradients are summed within a neighborhood ("search window") of $q$. Calling the first gradient term $G$ and the second gradient term $b$gives:

$$q = G^{-1} \cdot b$$

The algorithm sets the center of the neighborhood window at this new center $q$ and then iterates until the center stays within a set threshold.

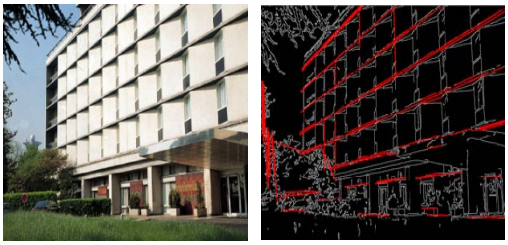
- In computer vision, usually we need to find matching points between different frames of an environment. Why? If we know how two images relate to each other, we can use *both* images to extract information of them. When we say **matching points** we are referring, in a general sense, to *characteristics* in the scene that we can recognize easily. We call these characteristics **features**. It must be *uniquely recognizable*

The Harris Corner Detector is a mathematical operator that finds features in an image. It is simple to compute, and is fast enough to work on computers. Also, it is popular because it is rotation, scale and illumination variation independent. However, the Shi-Tomasi corner detector, the one implemented in OpenCV, is an improvement of this corner detector.

$$E(u,v) = \sum_{x,y} w(x,y)[I(x+u, y+v) - I(x,y)]^2$$

The equation

- E is the difference between the original and the moved window.
- u is the window's displacement in the x direction
- v is the window's displacement in the y direction
- w(x, y) is the window at position (x, y). This acts like a mask. Ensuring that only the desired window is used.
- I is the intensity of the image at a position (x, y)
- I(x+u, y+v) is the intensity of the moved window
- I(x, y) is the intensity of the original
- And this is the output of the above program in case of the probabilistic Hough transform:



**Input Image** **Output Image**

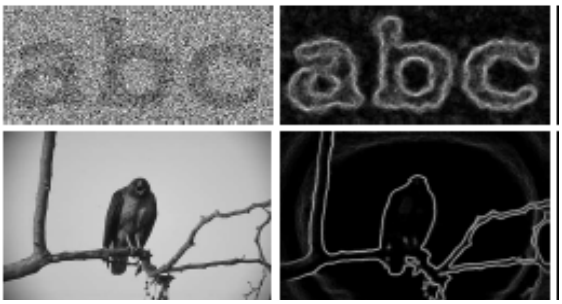
**Fig 9 : Harris Corner Detection**

### 3.2.MCMC (Markov chain Monte Carlo) Algorithm is used in classifying the shape patterns

In statistics, Markov chain Monte Carlo (MCMC) methods are a class of algorithms for sampling from a probability distribution based on constructing a Markov chain that has the desired distribution as its equilibrium distribution. The state of the chain after a number of steps is then used as a sample of the desired distribution. The quality of the sample improves as a function of the number of steps. Convergence of the Metropolis-Hastings algorithm. MCMC attempts to approximate the blue distribution with the orange distribution Markov chain Monte Carlo (MCMC) sampling methods are useful in a wide variety of applications. Level set representations eschew explicit curve and surface

parameterizations while allowing topological changes with superior numerical stability. MCMC methods enable one to reason about complex distributions for which exact analysis is intractable and additionally provide a more extensive characterization of energy minimization formulations when viewed from a Bayesian perspective. Integrating the two formalisms faces two distinct challenges. First, the high dimensionality of implicit representations induces a large configuration space resulting in slow convergence for naive implementations. Second, certain technical conditions induce a correspondence problem that, in prior efforts, has overly constrained the applicable class of curves (e.g. simply connected shapes). Here, we address these and additional issues resulting in a computationally tractable MCMC sampling algorithm over the space of implicitly defined shapes. This, in turn, simplifies the estimation of marginal statistics defined over the distribution of implicitly defined curves C for a given image I. While many level set methods are formulated as an energy minimization over some functional E (C; I), it is often the case that, either due to the ill-posedness of unsupervised segmentation or the stochastic nature of a well posed formulation, multiple plausible explanations exist. In either case, characterization of the posterior distribution is desirable; e.g., marginal statistics over the distribution may offer a more informative characterization than the optimal configuration. Consequently, a common alternative is to recast the optimization formulation as one of Bayesian inference by viewing the energy functional as the negative log of a probability density

$$p(C|I) \propto \exp(-E(C;I)). \qquad (1)$$



**Input** **Output**

**Fig 10: MCMC Shape Classification**

a threshold PB image, and the minimal energy segmentation obtained via the MCMC sampler described in the sequel. As with many MCMC samplers, the proposal distribution has a critical impact on the length of the mixing time, i.e. convergence to the stationary distribution from which we would like to sample. In addition to relaxing constraints on the allowed shape class (as compared to previous methods ), we suggest a design method for the proposal distribution that dramatically reduces the mixing time. In summary, the contributions of this work are threefold. First, we develop an MCMC sampling method for implicit shape representations that includes topological changes. Second, we extend the approach to the case of M-ary segmentations. Third, we achieve these improvements while simultaneously accelerating the sampling procedure by orders of magnitude over previous methods. While we utilize explicit formulations in order to demonstrate the method, the method itself is quite general and can be used for almost any static image feature and region based energy functional. We have presented an MCMC framework that allows one to sample from the space of segmentations. The formulation was developed with a general energy functional and image feature Random walk Monte Carlo methods make up a large subclass of MCMC methods.

**3.3.Hybrid SVM is applied for classification of images based on object features present in the training dataset such as humans, vehicles, plants, animals etc.,**

Object detection refers to a technology which is expounded to laptop vision and multimedia system information retrieval. prime quality object detection aims to solve the matter of sleuthing instances of linguistics objects of an explicit category (such as animals, plants, or humans) in pictures and videos. In object detection research field, face detection and pedestrian detection square measure discussed largely in recent years. moreover, object detection has applications in several analysis fields in computer vision, as well as multimedia system data retrieval and video police investigation.

As is a crucial analysis field in object detection, salient object detection is one in every of the vital issues in pc vision(CV), that have obtained many attentions in recent years. notably, visual saliency refers to the aptitude to notice the relevant object in a picture fast and accurately. the most works in salient object detection exist that every constituent within the host image is given a live of relevancy score. The above process will be conducted by giving higher values to the important image regions and lower values to different image regions. On the opposite hand, the matter of salient object detection aims to produce an acceptable answer to several complex period cases, together with police work systems to track vehicle . what is more, salient object recognition is additionally exploited within the application of automatic target detection, which has 1) Finding traffic signs on the road or military vehicles in an exceedingly savanna, 2) Finding salient objects within the atmosphere as navigation landmarks in AI

SVM belongs to a form of supervised learning models utilizing connected learning algorithms which may analyse knowledge or acknowledge patterns. Supposing there's a collection of coaching examples, in which each one is annotated with the class name. Furthermore, the SVM coaching method refers to construct a model which may allot new examples into one category or not, then construct a non-probabilistic binary linear classifier. Intuitively, the most plan of SVM are often described as that example is delineated as points within the space, then these points square measure mapped. The improvement objective of SVM is to separate the examples into completely different categories with a transparent gap that is as wide as doable. Afterwards, new

examples square measure then mapped into that very same house, and that category the example is belonged to are often foretold counting on which facet of the gap this instance fall in. However, the performance of SVM heavily depends on the parameter choice. supported the on top of analysis, we focus on the tactic of parameter choice for SVM in this paper. during this paper, we have a tendency to aim to notice salient objects in digital pictures with high accuracy and potency exploitation modified SVM , and also the native options square measure accustomed describe the visual content of pictures. significantly, the innovations of this paper square measure chiefly consist the subsequent aspects:

(1) we have a tendency to propose a unique approach to use a circular region to interchange the oblong region and that we assume that the affine and scale normalized regions are extracted ahead.

(2) To represent visual contents of the host image additional accurately, we have a tendency to style a hybrid of mixing PSO and SVM model through that the SIFT options bunch method and local options matching method are often enforced.

(3) To tackle the matter that the performance of SVM formula is greatly influenced by the standard of parameter choice, we have a tendency to utilize the technique to decide on suitable SVM parameters through analysing the convergence of particle swarm improvement and quantum system

(4) within the planned methodology, salient objects are often detected expeditiously by group action PSO and SVM together through image segmentation and interest points matching


**Fig 11. Sample Training Image**

To make the salient object detection more effectively, we use SVM to classify local features of the host images. Supposing there are a set of training images which are , where the conditions and are satisfied. Given , a regression model is defined which can describe the relation between and : 1 1 2 2 {(x1 ,y1 ), (x2 ,y2 ),.. , (xL , yL )} ix € iy R €i I is the regression model and the relation between x i f( xi)

$$f(x_i) = w \cdot x_i + b, b \in R, i \in \{1, 2, \cdots, l\}$$

Although SVM is a powerful computing tool, the quality of parameter selection is SVM could influence the system performance greatly. Therefore, in this section we will how to choose suitable SVM parameters using the particle swarm optimization(PSO) technique, which is designed by analysing the convergence of particle swarm optimization and quantum system. In PSO, the state of represented as the function , and exploiting the Monte Carlo$_{\varphi}$ (x, t) The center of pbest positions for a specific swarm is computed by the following equation.

$$mbest^t = (mbest_1^t, mbest_2^t, \cdots, mbest_N^t)$$

Combining the PSO and SVM together, host images can be segmented effectively and the interest points can be matched accurately, and then salient objects are extracted from host images.

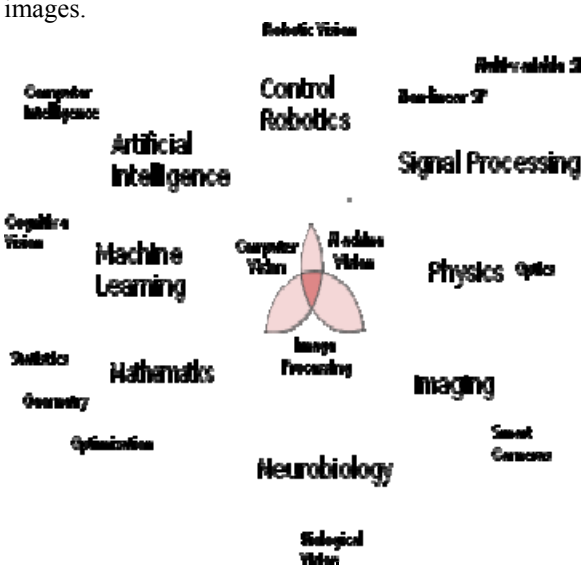



**Fig 12 .Architecture of Artificial Visual System**

A theme within the development of this field has been to duplicate the talents of human vision by electronically perceiving and understanding a picture. Understanding during this context suggests that the transformation of visual pictures (the input of retina) into descriptions of world which will interface with different thought processes and elicit applicable action.

This image understanding are often seen because the disentangling of symbolic info from image knowledge mistreatment models created with the help of pure mathematics, physics, statistics, and learning theory. Computer vision has conjointly been represented because the enterprise of automating and desegregation a good vary of processes and representations for vision perception.

As a subject area, pc vision is bothered with the idea behind artificial systems that extract info from pictures. The image knowledge will take several forms, like video sequences, views from multiple cameras, or multi-dimensional knowledge from a medical scanner. As a technological discipline, pc vision seeks to use its theories and models to the development of pc vision systems.

## IV. Experimental Results

In this paper, the series of experiments are style and implemented to create performance analysis victimisation different datasets, and different connected analysis works are compared with ours.

### 4.1 Datasets and Performance analysis Metric

The dataset used for salient object detection we tend to chosen is provided from paper [7]. In paper [7], the task of salient object detection is enforced by finding a bounding box round the most salient object within the digital image. This dataset is formed of 5 thousand pictures with manually tagged rectangles close to the foremost salient object drawn by completely different specialists. to attain the bottom truth, we raise some specialists to grant a bounding parallelogram to represent the thing. The projected salient object detection provides a parallelogram on the salient object that is detected. notably, the bottom truth is set by choose the parallelogram round the salient object victimisation the majority agreement of all the specialists we tend to chosen. The salient objects are diagrammatical by the bounding box with red colour.

### 4.2 Result

The dataset we tend to used is formed from a large-scale image database with 130 digital pictures from many categories, and principally of them are elite from the net. Afterwards, we elect 60 Digital pictures, in which each image includes a minimum of one salient object To make performance analysis a lot of objectively, another 200 images are elite that embody associate unambiguous object of interest to assist for constructing the bottom truth.

Particularly, the salient objects we tend to choose are completely different in diversity, as well as "category", "colour", "shape", "size" et al.. On the opposite hand, to point out the performance of the proposed salient object detection approach, MSRC dataset is additionally utilized that have many various object classes.

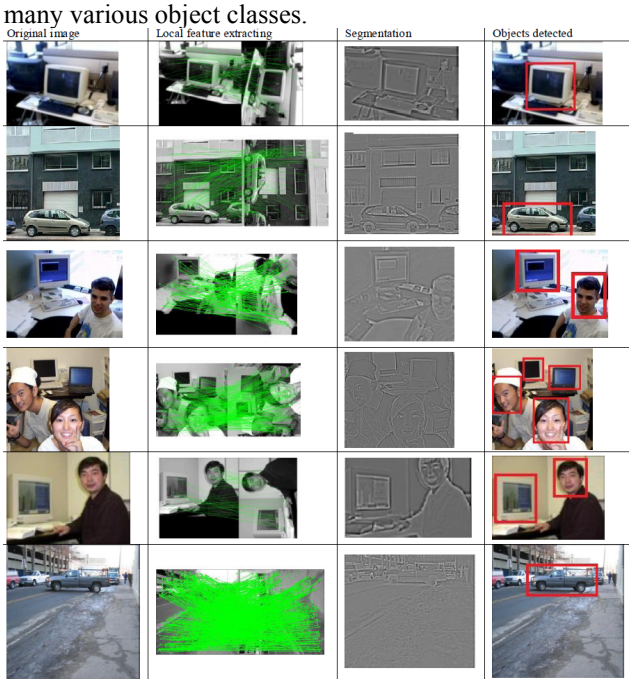



**Fig 13.(i)Original Image, (ii)Features Extraction, (iii)Segmentation , (iv) Object Classification**

Furthermore, the performance analysis metric we tend to used are exactness, recall, and F-measure. Precision/recall can represent the world quantitative relation of detected object and also the ground truth salient object region.

### 4.3 Precision

In the field of accuracy calculation, precision is the fraction of Total number of Test Inputs that are Correct Result to the find:

$$\text{precision} = \frac{|\{\text{Correct Result }\} \cap \{\text{Total number of Test Inputs}\}|}{|\{\text{Total number of Test Inputs}\}|}$$

### 4.4 Recall

Recall in of accuracy calculation is the fraction of the documents that are Correct Result to the input that are Total number of Test Inputs.

$$\text{recall} = \frac{|\{\text{Correct Result }\} \cap \{\text{Total number of Test Inputs}\}|}{|\{\text{Correct Result }\}|}$$

Precision and recall are then defined as, Recall in this context is also referred to as the true positive rate or sensitivity, and precision is also referred to as positive predictive value (PPV); other related measures used in classification include true negative rate and accuracy. True negative rate is also called specificity.

| Category | SVM | | SVM-PSO | |
|---|---|---|---|---|
| | P | R | P | R |
| tree | 0.493 | 0.501 | 0.656 | 0.697 |
| sign | 0.519 | 0.531 | 0.750 | 0.629 |
| flower | 0.556 | 0.573 | 0.659 | 0.741 |
| sheep | 0.530 | 0.520 | 0.662 | 0.636 |
| bird | 0.492 | 0.543 | 0.751 | 0.611 |
| aeroplane | 0.518 | 0.486 | 0.716 | 0.630 |
| body | 0.497 | 0.515 | 0.721 | 0.578 |
| car | 0.493 | 0.605 | 0.646 | 0.846 |
| building | 0.553 | 0.585 | 0.766 | 0.800 |
| cat | 0.503 | 0.494 | 0.774 | 0.620 |
| chair | 0.547 | 0.565 | 0.795 | 0.702 |
| cow | 0.503 | 0.532 | 0.775 | 0.642 |
| dog | 0.572 | 0.587 | 0.707 | 0.731 |
| face | 0.522 | 0.528 | 0.708 | 0.594 |
| book | 0.530 | 0.556 | 0.695 | 0.626 |
| Average | 0.522 | 0.541 | 0.719 | 0.672 |

**Fig.1 4 Precision and Recall Comparison Table**

It is possible to interpret precision and recall not as ratios but as probabilities:

- Precision is the probability that a (randomly selected) retrieved document is relevant.

- Recall is the probability that a (randomly selected) relevant document is retrieved in a search.

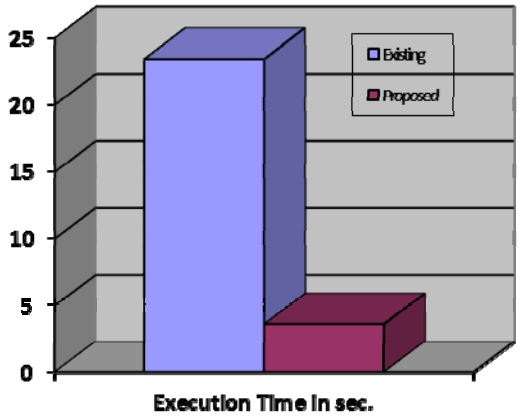



**Fig.15 Execution Time**

Note that the random selection refers to a uniform distribution over the appropriate pool of documents; i.e. by randomly selected retrieved document, we mean selecting a document from the set of retrieved documents in a random fashion. The random selection should be such that all documents in the set are equally likely to be selected.

Note that, in a typical classification system, the probability that a retrieved document is relevant depends on the document. The above interpretation extends to that scenario also. Another interpretation for precision and recall is as follows. Precision is the average probability of relevant retrieval.

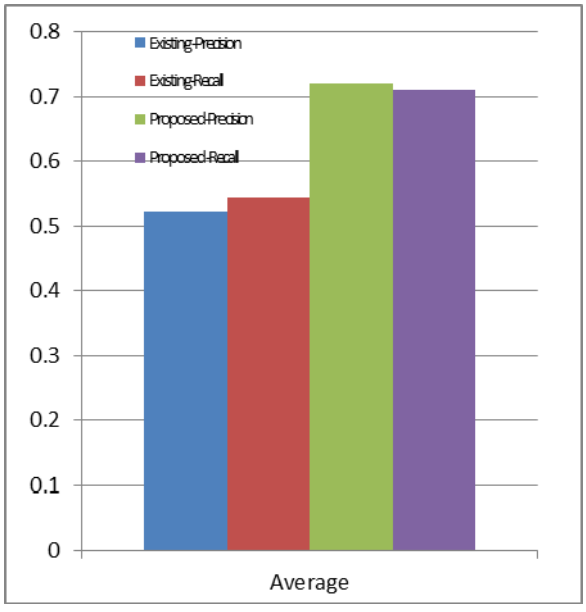



**Fig. 16 Precision and Recall Comparison Chart**

Recall is the average probability of complete retrieval. Here we average over multiple retrieval queries.

## V Conclusion

The Proposed research focus on classifying the image based on the information content such as medical, satellite or real world photography images respectively. Since the digital image processing researches are about to reach a greatest milestone in providing artificial visual system to computer which is similar to human visual system with all intelligent capabilities in understanding , perceiving, manipulating, reusing , analysing, recognizing, classifying , restoring, enhancing and applying it in corresponding environment based on the requirement as high level and in meaningful manner. The proposed research is a small initiating step to achieve the artificial visual system to computers by applying various algorithms and processing stages to classify the image based on the information content.

The system uses Harris Corner Detection algorithm for handling the edges and MCMC (Markov chain Monte Carlo) Algorithm is used in classifying the shape patterns present in the image. Hybrid SVM is applied for classification of images based on object features present in the training dataset such as humans, vehicles, plants, animals etc.

## VI Future Research

The Future research focus on multiple co-objects in Classifying images based on objects for understanding images in computer vision and video processing Application. The Machine intelligence Techniques might improve the accuracy when increasing the number of objects.

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