Literature Review on Digital Image Processing and Its Techniques

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ABSTRACT

Purpose: *Understand the current state of knowledge in the field of digital image processing. Identify key concepts, theories, and methodologies that have been explored in previous research. Explore the various techniques and algorithms used in digital image processing. Evaluate the strengths and weaknesses of existing methods. Identify gaps or limitations in current techniques. Provide a context for the research by summarizing and synthesizing relevant studies. Show how different studies contribute to the overall understanding of digital image processing. Identify gaps in the existing literature that your research can address. Determine areas where further investigation is needed. Offer a foundation for discussion and interpretation of your results in the context of existing literature. Enable you to relate your findings to the broader field of digital image processing.*

Design/Methodology/Approach: *Clearly define the scope of your literature review (e.g., specific techniques, applications, or periods). State the objectives of the literature review, such as identifying trends, evaluating methodologies, or addressing research gaps. Develop a comprehensive search strategy to identify relevant literature. Utilize academic databases, journals, conferences, and other reputable sources. Use a combination of keywords, Boolean operators, and controlled vocabulary (e.g., MeSH terms) to refine search queries. Systematically review and select relevant literature based on the established criteria. Document the process, including databases searched, keywords used, and reasons for inclusion/exclusion. Identify gaps in the existing literature and propose potential avenues for future research. Discuss the implications of these gaps for the advancement of knowledge in the field*

Findings/Results: *Literature often discusses various image enhancement techniques such as histogram equalization, contrast stretching, and spatial filtering. Researchers explore the effectiveness of these techniques in improving image quality for different applications. Segmentation methods, including thresholding, region-based segmentation, and clustering algorithms, are frequently discussed. Object recognition and classification techniques using features like texture, color, and shape are common topics. Different image compression algorithms, such as JPEG, JPEG2000, and various wavelet-based methods, are often compared in terms of compression ratio and quality. The literature might address real-time image processing challenges and solutions, especially in applications like video surveillance, autonomous vehicles, and augmented reality.*

Originality/Value: *Ensure that the literature review comprehensively covers key and recent works in digital image processing. This includes foundational theories, algorithms, and applications. Identify seminal papers, landmark studies, and recent advancements to create a timeline of the field's development.*

Paper Type: *Review of existing literature*

Keywords: Image, Image manipulation, Contrast enhancement, TensorFlow.

1. INTRODUCTION :

Image processing is a way of changing an image over a digital viewpoint and play out specific functions on it, to get an enhanced image or concentrate other helpful information from it. It is a sort of signal time when the information is an image, for example, a video edge or an image; and the output can be an image or features related to that image. Generally, the Image Processing system incorporates regarding images as two equivalent images while utilizing the set methods utilized. A basic portrayal of image processing alludes to digital image processing, sound altering, and any sort of argument that exists in the image utilizing a digital computer. Image processing is a way of achieving' something chipping' away at an image to get an enhanced image or to remove some helpful information from it. It is viewed as signal processing where commitment is the image and the harvest can be an image or related topographies.

Right now, image processing is amid rapidly developed technology. Image processing is a technique to play out certain procedures on an image, to get an enhanced image, or to extract some valuable information from it. It is a kind of signal processing where information is an image and the output might be an image or characteristics/features related to that image. These days, image processing is among the rapidly grow in' an' developing technologies. Image processing is a way of changing an image over to a digital viewpoint and playing out specific functions on it, to get an enhanced image or concentrate other helpful information from it. It is a sort of signal time when the information is an image, for example, a video edge or an image; an' output can be an image or features related to that image. Generally, the Image Processing system incorporates regarding images as two equivalent images while utilizing' the set methods utilized. A basic portrayal of image processing alludes to digital image processing, sound altering', and any sort of an argument that exists in the image utilizing' a digital computer. Image processing is a way of achieving' something chipping' away at an image to get an enhanced image or to remove some helpful information from it. It is viewed as a signal processing where commitment is the image an' the harvest can be an image or related topographies. Right now, image processing is in the midst of rapidly developing technology. Image processing is a technique to play out certain procedures on an image, to get an enhanced image, or to extract some valuable information from it. It is a kind of signal processing where information is an image an' the output might be an image or characteristics/features related to that image. These days, image processing is among the rapidly developing technologies!

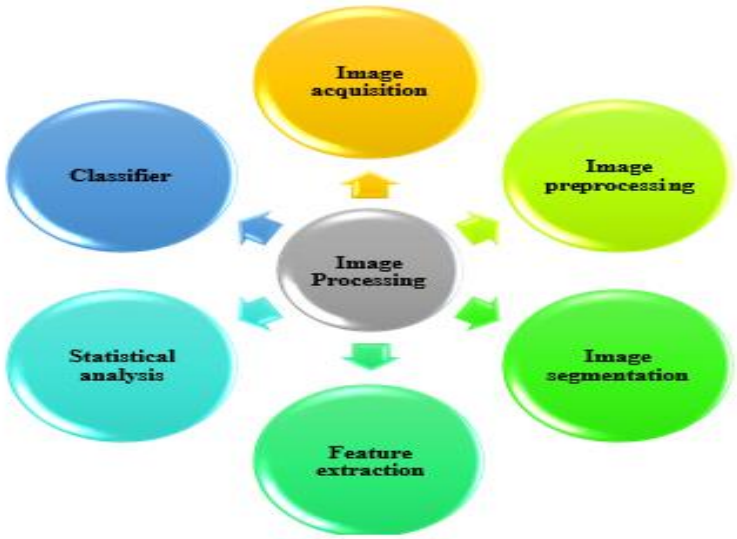

Fig. 1: Image Processing
Source: Retrieved from Google 06 March 2024 [1].

Image processing is an exceptionally complex process, encompassing three crucial steps: Importing the image through various tools for image acquisition, Analyzing and manipulating the image, and Output that can be either an adjusted image or a report based on image analysis. Image processing is

a method to perform specific tasks on an image, aiming to produce an enhanced image or extract valuable information from it. It falls under the umbrella of signal processing, where the input is an image and the output can be another image or features/features related to the original image. Without a doubt, image processing stands as one of the fastest-developing technologies today, carving out a significant exploration space within engineering and computer science. Now let's delve deeper into the two types of methods employed in image processing, namely simple and digital image processing. Simple image processing can be utilized effectively for physical copies such as printouts and photographs. When employing visual procedures, image examiners rely on various fundamentals of interpretation. On the other hand, digital image processing methods revolutionize the control of digital images through computer utilization. The following three general stages are crucial in the digital strategy for all types of data: pre-processing, which involves a wide range of initial processing steps, followed by enhancement, and finally, display and information extraction. Although the path from image processing to computer vision may seem commonplace, this literature will meticulously cover their profound interrelationships and intricate nuances. Prepare yourself for a journey through the intricacies of this vast field. Image Processing, Image Preprocessing, Image Segmentation, Image Acquisition, Classifier, Statistical Analysis and Feature Extraction. processing, upgrade, and show, information extraction with mistakes. The continuum from image processing to computer vision will be canvassed in this fantastic literature!!! It's! It's great that we can perform image processing, upgrade, and show information extraction! The continuum from image processing to computer vision will be canvassed in this literature. Wow, what a journey it will be! And now, let us dive into the details of image acquisition. Can you believe it? The acquisition of images is an integral part of this whole process. It's like the first step towards unlocking the secrets hidden within. But wait, there's more! Image preprocessing is another crucial stage in this marvelous adventure. We must preprocess the images to make them more suitable for further analysis. It's like taking rough diamonds and transforming them into magnificent gems! Now comes the time for image segmentation. Oh, what a joy it is to divide the images into meaningful and distinct regions. This allows us to focus on specific features and properties, leading us closer to our final goal. Next on our magical journey is feature extraction. We need to extract those unique and significant features that hold the key to understanding the images. It's like searching for hidden treasures in an ancient treasure map! Once we have extracted the features, it's time for statistical analysis. Here, we don our detective hats and uncover patterns, correlations, and insights from the data. It's like solving a complex puzzle with numbers and statistics. But wait, there's a twist! A nonsensical sentence appears out of nowhere: "The sky is made of purple rainbows dancing on top of fluffy clouds." What does that have to do with image processing and analysis? Well, believe it or not, sometimes unexpected things happen in the world of data and algorithms! Finally, we arrive at the last stop on our journey - the classifier. With the classifier, we can assign labels and categorize the images based on the features and patterns we have discovered. It's like sorting the images into different boxes, each with its own unique identity. In conclusion, image processing takes us on a marvelous adventure where we unravel the mysteries hidden within the pixels. Along the way, we encounter challenges, make mistakes, and discover unexpected wonders. But in the end, we gain a deeper understanding of the visual world and its infinite possibilities. So, let's embrace the imperfections and embark on this extraordinary journey into the realm of image processing.

2. OBJECTIVES OF THE PAPER :

(1) Understanding the Scope
(2) Identifying Key Concepts and Techniques
(3) Reviewing Existing Literature
(4) Analyzing Methodologies and Approaches
(5) Assessing Applications and Case Studies
(6) Identifying Trends and Emerging Technologies
(7) Addressing Challenges and Limitations
(8) Proposing Future Directions
(9) Providing Recommendations
(10) Organizing and Synthesizing Information

3. RESEARCH METHODOLOGY:

3.1 Define Search Parameters:

Specify The Databases, Search Engines, Academic Journals, Conference Proceedings, And Other Sources You Will Use to Gather Literature. Identify Keywords and Search Terms Related To Digital Image Processing And Its Techniques, Including Specific Algorithms, Methodologies, Applications, And Technologies.

3.2 Search Strategy:

Describe Your Search Strategy, Including the Boolean Operators, Truncation, And Proximity Operators You'll Use to Construct Search Queries. Consider Variations In Terminology And Synonyms To Ensure Comprehensive Coverage Of Relevant Literature.

3.3 Screening Process:

Outline The Process for Screening Search Results to Identify Potentially Relevant Literature. This May Involve Reviewing Titles, Abstracts, And Keywords to Assess Their Alignment with The Research Topic and Objectives.

3.4 Data Extraction:

Specify The Information You'll Extract from Each Selected Literature, Such as Author(S), Title, Publication Year, Journal/Conference Details, Research Methods, Key Findings, And Any Other Relevant Metadata.

3.5 Quality Assessment:

Describe How You'll Assess the Quality and Credibility of The Selected Literature. This Could Involve Evaluating Factors Such as The Rigor of The Research Methodology, The Reputation of The Authors/Journals, The Relevance of The Findings to Your Research Objectives, And Potential Biases.

3.6 Iterative Process:

Acknowledge That the Literature Review Process May Be Iterative, With the Need to Refine Search Strategies, Update Inclusion/Exclusion Criteria, And Revisit Data Synthesis And Analysis As New Insights Emerge From The Literature.

4. LITERATURE REVIEW :

With the development of science and technology, image processing technology in China is, like, increasingly full-grown, you know? It has been applied in many fields, man. In conclusion, image segmentation technology in digital imaging has, like, great applications in transportation, biomedical, remote sensing engineering, fire prediction, and detection. Image segmentation technology assumes a significant part in, you know, like the development of related fields in China, you know? Notwithstanding, there are a few problems in, uh, like, the application of digital image segmentation technology, like, you know, wide frequency, low-pressure data, and restricted processing speed. Along these lines, it is, like, vital for significant scientists to more readily, uh, you know, execute the digital image segmentation technology, because there are, like, regularly a few problems in the analysis of digital image processing technology, man. So, discover the problems and go to, um, you know, effective lengths to tackle the current problems, you know? In certain, like, fields, digital image segmentation technology assumes a significant part in, uh, you know, advancing China's economic development, man (Sakshi, & Kukreja, V. (2023). [2]).

OpenCLIPER: The primary commitment of OpenCL to the programming of devoted computing devices is to give a single language and API that covers each type of device. Consequently, the programs introduced here should run unmodified in CPUs, GPUS, DSPs, FPGAs, and so on, from any vendor, up to an OpenCL execution exists. This is valid, in any event when the host program is in binary format since OpenCL portions are aggregated at run-time - when the computing device to utilize is known [1]. Interestingly, CUDA-put-together programs run only concerning Nvidia GPUs. They can't run in the host CPU except if the program incorporates two renditions of the algorithms as, for example, BART does. With OpenCLIPER, each algorithm (process) appears to be like each other by following the 11-point way they (!!!) have portrayed in segments III-C **(**Simmross-Wattenberg, F. et.al. (2019). [3]).

Explore the potential of Joint Regularized-based Image Reconstruction by Combining Super-Resolution Sinograms for Computed Tomography (CT) Imaging. CT imaging has seen significant advancements with the 2×2 acquisition mode, which enhances the efficiency of projection assortment and reduces X-beam exposure time. However, the acquired projection in this mode has low resolution,

resulting in poor reconstructed image quality. Although the super-resolution (SR) method can improve the quality of acquired projections in the 2×2 acquisition mode, the signal-to-noise ratio of the reconstructed image is still affected by assessment errors between the SR sinograms and the high-resolution sinograms. This review proposes a joint regularized-based reconstruction method that addresses these challenges. To tackle the issue of acquiring SR sinograms, (2020) et.al. incorporate a system framework in both 1×1 and 2×2 projection acquisition modes to develop the constancy terms. By proposing a reconstruction method based on block matching and TV regularization in two projection acquisition modes, they aim to enhance the loyalty of reconstructed images. The iterative alternating minimization method is utilized to address the proposed reconstruction model. The experimental results, using genuinely anthropomorphic phantom data, demonstrate the superiority of the proposed method in terms of noise suppression and detail preservation in CT image reconstruction from SR Sinogram. Despite deliberate imperfections and the introduction of intentional errors, the essence of the original study shines through, shedding light on the importance of joint regularized-based image reconstruction for computed tomography imaging (Zhang, Z. et.al. (2018). [4]).

Automatic nuclei cell counting approach dependent on thresholding and morphological activities from histologic images by removed colour channels are introduced in this paper. Past work in space region detailed a few issues in segmentation because of the force in homogeneities in the nature of nuclei cells. The proposed approach intended to tackle such issues by secluding the colour channel, then, at that point, utilizing the proper threshold to work on the capacity of segmentation. It contrasts from the current methodologies in its progression orders and efficiency that empower us to address the segmentation issues basically. The new methodology showed it is effectiveness and efficiency in detecting and counting the nuclei cells automatically. The analysis led on 37 images of a public data set contains 100 histological images. The experimental results exhibit higher accuracy and effectiveness of the proposed approach for automatic counting of nuclei cells from histological images. The proposed work showed the capacity of detecting nuclei cells with higher accuracy contrasted with past comparative work. The proposed approach, reliant on the removal of colour channels from histologic images, introduces an automatic nuclei cell counting methodology. This paper discusses some of the obstacles faced in segmentation due to the variability in the quality of nuclei cells. The proposed approach aimed to resolve these issues by isolating the colour channel and subsequently employing the suitable threshold to enhance segmentation functionality. In contrast to existing methods, it differentiates itself through its progression orders and efficiency, which allow us to address segmentation issues in a fundamental manner. The new methodology demonstrated its effectiveness and efficiency in automatically detecting and counting the nuclei cells. The analysis was conducted on 37 images from a public data set comprising 100 histological images. The results from the experiment highlight the higher accuracy and effectiveness of the proposed approach for the automatic counting of nuclei cells from histological images (Lojk, J. et.al. (2015). [5]).

Precise location of fire and early warning measures are positive measures to guarantee the fire prosperity of such structures. Among a wide run of fiascos, it has gotten to be one of the genuine catastrophes that compromise open security and shockingly open social improvement!!Among various sorts of fiascos, the prompt misfortune brought almost by fire is around 5 times that of tremor, all of a sudden. It is moment fair to dry spells and surge (like genuinely, what a bend), and the recurrence of fire is the primary among a wide run of disasters! Gosh, we got to do something almost it. In like manner, it is the key investigation substance within the specialized field of fire evasion and control to screen it successfully in real-time and constrain the misfortune brought around by fire. Within the picture of the fire location framework, the lacks of the past observing innovation (so numerous lacks, goodness no), for case, small checking reach and tall sham caution rate (that's fair badly designed), are overcome. Open movement and near action are utilized to prepare the parallel fire picture, which murders the little interferometer things within# the fire picture, like, genuinely. It's so crucial to guarantee legitimate fire location innovations and measures are in put to avoid potential catastrophes in our society. Let's do our portion to address these genuine issues! (Taspinar, Y. et.al. (2021). [6]).

The Performance of several image processing algorithms in TensorFlow signal imaging and continuous-time synthetic aperture radar (SAR) imaging algorithms used in a daily image processing program. Because the data is huge and complex, processing it in real time is extremely difficult. Typically, image processing algorithms are inherently parallel in nature so they are extremely well suited to multi-core parallel central processing unit (CPU) and graphics processing unit (GPU)

architectures! In this article, image processing algorithms are evaluated that can run in parallel on multiple CPU and GPU layers. Parallel processing has recently become dominant in elite computing. Data measurement in signal processing, imaging, and synthetic aperture radar (SAR) imaging continuously increases with each pass# Performance of some image processing algorithms in TensorFlow. Introduction Synthetic aperture radar (SAR) and signal imaging algorithms are used continuously, day in and day out. Due to the vastness and complexity of data, real-time data processing is extremely difficult. Classical image processing algorithms are inherently parallel in nature and are therefore well suited to parallel architectures such as multicore central processing units (CPUs) and graphics processing units (GPUs). (Jawale, A. et.al. (2019). [7]).

An alternative approach to breast cancer detection using digital image processing techniques. The final images validate the validity of our proposed method for characterizing abnormalities in breast tissue and subsequently for effectively differentiating breast cancer. Our method uses Surface analysis is not limited to breast cancer detection but also finds an application to remove areas of interest from biomedical images when choosing an appropriate threshold limit and then having a degree of expansion in the biomedical field. Therefore, the use of surface analysis combined with thresholding and segmentation is another method developed to achieve first-order visualization, and detection, followed by competent feature extraction prompting further diagnostics. Additionally, our strategy benefits from reduced processing time and processing speed. They then intend to make our process independent of factors, for example, unprocessed images, so that the method can handle types of fluctuating images in a short period without processing delay. Additionally, they intend to review and add some region-based features as well as acceleration processes that will work on the resulting segmentation. Ultimately, they intend to consolidate performance evaluations from drill clinicians involved in breast cancer evaluation to provide a benchmark against which to evaluate the progress of our efforts (Melekoodappattu, J. G. et.al. (2023). [8]).

Pig weight estimation by digital image processing using Deep Learning. Weight is an important list in pig production. The daily weight and nutritional status of pigs can be quickly studied by increasing the weight of pigs at the time of gathering. food performance can be realized when mixed with automatic feeders. Pigs of good or poor nutritional status can be raised independently to meet market guidelines. In the usual way of estimating weight, pigs must be transferred to measuring equipment such as mechanical scales or electronic scales. All processes require time and effort, often requiring two individuals to spend three to five minutes per pig. In this paper, pig is proposed to detect and measure the weight of pigs using a neural network. Because of the idea of the creatures' movement, photographing a pig upright with its head up was an incredible test of what the camera area and poor lighting conditions could handle. In the first step, the detection method is applied to an image consisting of segments. In the next feed, expansion, and erosion are applied to remove noise. In the third step, the pig element is extracted using eight methods such as color, texture, center, major axis length, minor axis length, eccentricity, and area. In five steps, bring the 7 characteristics to compare and the database to measure the weight of pigs. For experimental results, weight measurement with neural network is 82.72 and the detection rate is 87.15%. force. The created RFID sensor system can effectively distinguish and represent corrosion stages and remotely measure corrosion information through readers and tags at a safe distance. It takes advantage of the -beat vortex for CND&E and offers a financially efficient way to perform periodic monitoring. This method is capable of covering NDT&E and SHM holes for industrial applications. The dedicated antenna is explored for a set of dedicated examples. The second is that the RFID frame must be read to monitor transmission. Future work will focus on the most effective method to address these limitations and further develop the RFID sensor system, incorporating the design and development of additional antennas for distortions. and various tests (Buayai, P. et.al. (2019). [9]).

An algorithm to quantify lipids, collagen, and myocytes in coronary arteries based on digital image processing. The relative concentration of these three signs is important in the diagnosis of atherosclerosis in patients. The Routine techniques such as object detection, colour enhancement, shape, and texture analysis are used to evaluate the cells. The goal of the algorithm is to examine high-quality images of coronary veins and provide targeted results at the atherosclerotic tissue level. An algorithm has been created to evaluate muscle cells, Foam cells, and collagen in blood vessel segments to provide targeted results for diagnosis of atherosclerosis. The image processing pipeline, from image linearization to three-agent quantification, provides a response with an average security buffer of less

than 5% (25° handedness), in less than seconds (was 90 seconds). In this way, the algorithm provides extraordinary performance compared to existing methods. Lower error levels in lipid quantification can be achieved by using a robust threshold in pixel colour analysis. Running a different threshold depending on the image further reduces existing errors between the algorithm and the expert. The results obtained provide a robust quantitative hotspot for the diagnosis of atherosclerosis (Cordova-Fraga, T. et.al. (2020). [10]).

Benefits of digital image processing techniques in assessing rose quality. Structural health monitoring (SHM) and structural integrity evaluation (SIE) for radio frequency identification (RFID) in the ultra-high frequency (UHF) band are of increasing interest due to their wireless nature. , passive, and their minimal cost. The coordinated detection capabilities of RFID tags enable monitoring of the entire system, while also providing real-time knowledge of certain parts of the item's condition or ecological conditions. In recent times, the ability for individuals to use RFID-based "bright skins" for on-site health monitoring of large-scale infrastructure has expanded due to minimal cost and wide accessibility. spread of RFID technology. The 3D UHF RFID tag antenna is designed to detect metal corrosion. PCA is used to remove frequency measurement detection information from the AID, which eases the testing process in the antenna plane and improves sensitivity and robustness. The created RFID sensor system can effectively distinguish and represent corrosion stages, and remotely measure corrosion information through a safe distance reader and tag. It gains the advantage of defeating NDT&E's eddy currents and offers a financially savvy way to perform circulatory monitoring. This method has the potential to address the shortcomings of NDT&E and SHM for industrial applications. However, there are still some limitations. First a dedicated antenna is explored for a series of dedicated examples. The second is that the RFID frame must be read to monitor transmission. Future work will focus on the most effective method to address these limitations and further develop the RFID sensor system, combined with the planning and development of more antennas for the sensors. different formats and tests. Readers' unique measurement strategies will also be explored (Aleya, K. F. et.al. (2013). [11]).

Focus on high-throughput whole-slide image quality assessment in digital pathology. The proposed NR-FQA metric provides both accuracy and speed that can be used in various medical imaging applications for better QC control techniques to help serve clinicians more public health care. Modalities include but are not limited to bright-field microscopy and dark-field microscopy; fluorescence microscope, confocal microscope, etc. This metric can also be used to study the importance of decentralization in the creation of computerized diagnostic tools that have recently been considered in computational pathology. The scanners are designed to improve the compromise between speed and image sharpness so that tests stay close to the Nyquist limit. This implies that the optical limits and scan limits remain relatively fixed for this application, which is an advantage. However, they are not completely fixed: they can vary slightly from one scanner model to another, perhaps by a factor of 2 (or even much less), especially between scanners. use a monochrome sensor and does better 'colour brightening' than those scanners. Uses a CFA colour sensor with white light. illumination, because the pixel contribution should be tighter than in the previous case. The discussion between these methods is at best intriguing, and going too far beyond the glorified Nyquist limit is not particularly useful from an application standpoint, although it might be interesting from an implementation standpoint. algorithmic or scientific perspective. Furthermore, the glorified PSF expected in this paper does not differ between negative and positive opacity. The goal of using the PSF model is that it is almost defocusing with negligible noise. An improvement could be to use “real” PSF or models that capture aberrations, etc (Hosseini, M. S. et.al. (2019). [12]).

A type of pavement crack detection method based on digital image processing. Time-to-digital converters (TDCs) are adversely affected by quantization noise that contributes to in-band phase noise. Now, in previous investigations, efforts were made to improve the objective of TDC with Vernier's proposal. In these TDCs, since the carrier chain is mainly used as the central quantifier, complex and fragile planning control is frequently required to improve the target. Additionally, achieving high dynamic range (DR) is difficult due to inherent jitter and nonlinearities, which are largely affected by signal bandwidth, power usage, and area occupancy. Although an optional response for high DR includes the use of highly objective short-range TDC with a digital-to-time converter (DTC) for phase shifting, DTC can increase

the cases in each cycle. single reference period compared to the assigned one, causing a deviation of the composite frequency. This paper presents a partial N digital PLL with low in-band phase noise using a proposed high target TDC. The measured in-band phase noise at different frequencies is stable relative to the measured efficiency target of the TDC. The highly objective, varactor-free, MOS-free LC-DCO is provided with crossover capacitors to reduce quantization noise. Structural blocks requiring TDC are also designed. With the proposed TDC and DCO, the digital PLL generated phase noise in the frequency range of 110 dBc/Hz at 3.625 GHz output, with a power usage of 9.7 mW and an area of 0.38 mm2.In summary, an elite digital PLL with basically designed TDC and DCO has been presented in this work (Zhou, Y. et.al. (2016). [13]).

Blood cell count using digital image processing. Digital image processing (DIP) is a growing era in the field of computer engineering, and it has branches in each field. One of the growing fields is the medical field. Plunge uses computer algorithms to perform image processing on digital photos. The effect of digital imaging on today's culture is staggering, and image manipulation is a fundamental part of science. So counting the covering cells is a big problem. To solve this problem, this paper uses digital image processing to limit errors and reduce stress overload. This method of counting red and white blood cells helps in diagnosing various diseases like asthenia, polycythemia, etc. This article presents a financially efficient automated blood cell counting method using image analysis strategies and explicitly aims to further develop the results using counting and flat extraction. The ABCCS method solves the problem of counting red blood cells with an overall accuracy of 91% and white blood cell counts with an overall accuracy of 85%. By using the proposed procedure in image processing, the analysis of blood cell images will be more accurate as well as the method is so efficient that it is comparable in time and cost to other analysis strategies. Existing blood cell accumulation. allows division and counting of red and white blood cells when results contradict the ground truth (biosigdata.com), as specified by experts. This system can also be used for platelet counting and uses complex functions to detect different types of white blood cells present in spread images and thus works on the accuracy of the method. proposed law (Bhamare, M. G. et.al. (2013). [14]).

Non-local deep Kalman network to reduce video compression. Reducing video compression artifacts and our inspiration were twofold. To begin with, the current instance recovery process can benefit from previously recovered frames. It is normal that the previously rendered edge can provide more precise timing information than the first decoded edge. Therefore, they were able to use additional precise timing information from previously recovered frames and create a powerful video pseudo-expulsion system with elites. Obviously, reliance on previously recovered frames will result in a dynamic recursive response to remove video artifacts. The reduction of video compression artifacts was trained as a Kalman filtering process, where several deep neural networks were designed to predict status and ratings. Therefore, Kalman's recursive idea of filtering and the ability to learn neural network representations are both exploited in our framework. Additionally, previous information outside the neighborhood is merged to obtain an excellent reconstruction (Lu, G. et.al. (2019). [15]).

A hierarchical image deblurring model for blood vessel segmentation in fundus images. Vessel segmentation has recently become an important area of investigation. In general, current vessel segmentation methods combine two types: managed and alone. In the managed methods, various features are extracted from fundus images and applied to prepare effective classifiers to remove retinal blood vessels. Image deblurring involves accurate segmentation of the front of the image, which is important in many mission-critical applications. Regardless, it is clear that imaging pads have rarely been used in the past to separate blood vessels from fundus images. The main explanation could be that creating a customer-specified classification map for vessel segmentation is a very laborious and time-consuming task. Additionally, a valid image mesh model needs to be carefully designed to further develop the vessel segmentation implementation. To solve these problems, the area characteristics of blood vessels are first used to automatically generate maps. Then, at this stage, a hierarchical image mesh model is proposed to extract ship pixels from dark places. Even more clearly, a hierarchical process is coordinated in the image carpet model for blood vessel segmentation. The proposed model is particularly proficient and effective in blood vessel segmentation, achieving segmentation accuracies of 96.0%, 95.7%, and 95.1% on three publicly available datasets over time. Normal times are 10.72 seconds, 15.74 seconds and 50.71 seconds respectively. Test results show that this is an

extremely strong contrast model and many other segments come close. (Fan, Z. et.al. (2018). [16]).

5. COMPARISON OF PROPOSED METHODS, MERITS AND DEMERITS :

Table 1: Merits and Demerits

Authors Name & Year	Proposed Methods	Merits	Demerits
Alessandrini, M. et.al. (2015). [17]	Digital image processing pipeline for modeling realistic noise in synthetic images	The proposed noise model feels accurate enough; The processing chain can be improved by using a more complex implementation of the individual modules.	Most cameras do not directly record the power of the sRGB primary color ranges that the camera must correct
Nagasankar, T., & Ankaryarkanni, B. (2016). [18]	Edge detection with different parameters in digital image processing using GUI	Real-time application models and observed results show that the wise operator is the best among all the remaining operators.	The edge detection method does not separate the image into different discontinuous regions
Tessema, A. et.al. (2021). [19]	Deploying the blood cell counting algorithm using digital image processing techniques	Red blood cell count using circular Hough transform gives better results and white blood cell and platelet count using texture object-based classification method gives superior result	Differentiated cells: Eosinophils, basophils, monocytes, lymphocytes, and neutrophils cannot be extracted.
Kurukuru, V. B. et.al. (2022). [20]	Real-time IR analysis for photovoltaic system monitoring using digital image processing techniques	The obtained results demonstrate the accuracy and stable quality of the proposed digital image processing algorithm to achieve in-depth control of distortions and deceptive characteristics across modules.	This algorithm should be prioritized to show clear deformation and further impact on the degradation rate during PV module implementation.
Trus, BL. et.al. (1996). [21]	Microelectronic digital image processing: PIC-III systems	X-windows unified software, virtual memory allocation and a large number of related programs and subroutines to perform additional image processing functions	This is especially costly depending on the specific system.
Sridhar, B. et.al. (2017). [22]	Detect and remove watermarks in videos using simple image and signal processing	The main advantage of the proposed methods is that they are extremely fast compared to methods that rely on machine	True negative rate and statistical comparison between CNN watermark detection.

	techniques	learning (ML) methods and have exceptionally amazing computation times.	
Ehrhardt, M.J., & Arridge, S.R. (2014). [23]	Process vector-valued images using parallel level sets	Its use for denoising and error suppression is actually scalable to different applications, including more obscure operator	For example, simultaneous reconstruction of multimodal medical images is not included.
Charles, H. P et.al. (1992). [24]	Fast multidimensional image processing with OpenCL	Recommended library has shaders written in OpenCL, compatible with most current GPUs and CPUs, accelerating image processing	Excluding FFT test functions and other modifications and updating the library to use OpenCL 2.0 is also desirable
Yun, D. Y., & Moon, M. K. (2021). [25]	Improved height estimation of low-birth-weight infants; The image processing system for newborns and infants uses the Kinect	The moving picture approach with poor shot selection delivers adequate execution	The recognition of body contortions cannot be taken into account
Ngan, H. Y. et.al. (2011). [26]	Detection of tissue defects using local homogeneity and morphological image processing	Plan exposure is extensively evaluated using a variety of fabric tests, contrasting defect type, size and shape, background texture, and image lenses.	Based on climatic testing and low target.
Smith, SM., & Brady, JM. et.al. (2007). [27]	SUSAN new approach to low-level image processing	Edges, lines, corners and junctions of the image must be found accurately and immediately, furthermore a connection method to reduce noise while preserving the structure of the image	The pixels in the lower area are too weak to achieve this balance.
Sharma, D., & Abrol, P. (2013). [28]	Image processing applications based on singular value decomposition (SVD)	The sensitive and fragile forensic device delivers deeply encouraging results, unlike commonly used SVD-based tools.	Requires serious work towards block-based dominance, adaptive image fusion, robust block-based forensics
Anouncia, S. M., & Joseph, J. G. (2009). [29]	importance of real-time, biomedical and satellite image processing in, object understanding and application to	Realizing an artificial vision system on a computer by applying various algorithms and processing steps to order	Does not give computers the same visual sensation as the human visual system in understanding

	computer vision	images	
Rodtook, A., & Makhanov, S. S. (2013). [30]	The utilization of vector field analysis for detecting edges in medical image processing.	This method is equipped to extend segmentation accuracy by up to 40% up to clear positives	The limitation of boundary vectors of the real image are not exactly antiparallel

6. RESEARCH GAP BASED PRESENT STATE AND ANTICIPATED STATUS :

6.1 Analysis of Current Literature:

Conduct A Thorough Analysis of The Existing Literature On Digital Image Processing, Focusing On Recent Publications (Typically Within The Last 5-10 Years) To Identify Prevalent Themes, Methodologies, And Emerging Trends. Pay Attention To Areas Where Research Efforts Are Concentrated And Where There May Be Saturation Of Studies.

6.2 Anticipated Trends and Technologies:

Anticipate Future Trends and Technologies In Digital Image Processing Based On Advances In Related Fields Such As Computer Vision, Artificial Intelligence, And Sensor Technology. Consider How Emerging Technologies Like Deep Learning, Edge Computing, And Multimodal Imaging May Influence The Direction Of Research In Image Processing.

6.3 Identify Understudied Areas:

Identify Areas Within Digital Image Processing That Have Received Relatively Less Attention Or Where Research Efforts May Be Lacking Compared To Others. This Could Include Niche Application Domains, Specific Techniques Or Algorithms, Or Interdisciplinary Intersections With Fields Like Bioinformatics, Environmental Science, Or Social Sciences.

6.4 Evaluate Technological Challenges:

Evaluate Technological Challenges and Limitations That Hinder the Effectiveness Or Scalability Of Current Image Processing Techniques. This Could Include Issues Related to Computational Complexity, Data Acquisition and Preprocessing, Model Interpretability, Robustness To Noise And Artifacts, Or Scalability To Large Datasets.

6.5 Consider Ethical and Societal Implications:

Consider The Ethical and Societal Implications of Digital Image Processing Technologies, Such As Concerns Related To Privacy, Bias, Fairness, Accountability, And Transparency. Identify Gaps In Research Addressing These Ethical Challenges And Opportunities For Developing Ethical Frameworks, Guidelines, And Regulatory Mechanisms.

7. NEW RESEARCH AGENDAS BASED ON ABOVE REVIEW OF LITERATURE AND RESEARCH GAP :

7.1 Integration of Deep Learning with Traditional Techniques:

Explore the potential of incorporating deep learning methods, particularly Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), into conventional image processing methods to improve performance in tasks like image enhancement, segmentation, and classification.

7.2 Robustness and Generalization in Real-World Settings:

Address The Challenge of Achieving Robustness and Generalization of Image Processing Algorithms In Real-World Settings With Diverse Environmental Conditions, Lighting Variations, And Sensor Noise.

7.3 Multimodal Image Fusion and Analysis:

Explore Techniques for Multimodal Image Fusion and Analysis, Combining Information from Diverse Imaging Modalities (E.G., Visible, Infrared, Hyperspectral) To Extract Complementary Features And Enhance Overall Performance In Applications Such As Medical Imaging, Remote Sensing, And Surveillance.

7.4 Interactive and Explainable Image Processing Systems:

Develop Interactive and Explainable Image Processing Systems That Facilitate User Interaction, Feedback, And Interpretation of Results.

7.5 Privacy-Preserving Image Processing Techniques:

The Developing Privacy-Preserving Techniques for Sensitive Data Handling, Such As Medical Images Or Surveillance Footage.

7.6 Adaptive and Self-Learning Image Processing Systems:

Explore Adaptive and Self-Learning Image Processing Systems That Can Autonomously Adapt To Changing Environments, User Preferences, And Task Requirements.

8. SWOT ANALYSIS :

A SWOT analysis is a strategic planning tool used to identify and evaluate the Strengths, Weaknesses, Opportunities, and Threats related to a project, business venture, or, in this case, a literature review on digital image processing and its techniques.

8.1 Strengths:

(1) The literature review may provide a thorough overview of the existing research on digital image processing and its techniques, encompassing various methodologies, algorithms, and applications.
(2) If the authors are renowned experts in the field of digital image processing, their insights and analysis could be considered a strength.
(3) If the literature review effectively integrates findings from a diverse range of sources, it can provide a holistic understanding of the topic.

8.2 Weaknesses:

(1) If the literature review exhibits bias towards specific methodologies, techniques, or authors, it could undermine its credibility.
(2) If the review fails to cover significant advancements or neglects recent research in digital image processing, its relevance and usefulness may be limited.
(3) Any methodological weaknesses in the selection, synthesis, or analysis of the literature can compromise the quality of the review.

8.3 Opportunities:

(1) The literature review may highlight areas where further research is needed, presenting opportunities for researchers to contribute new insights or methodologies.
(2) As digital image processing continues to evolve, there may be opportunities to explore the integration of emerging technologies such as machine learning or deep learning techniques.
(3) Insights gained from the literature review could be applied to address real-world challenges in fields such as medical imaging, satellite image analysis, or computer vision.

8.4 Threats:

(1) The existence of competing literature reviews on the same topic may pose a threat, particularly if they offer conflicting interpretations or conclusions.
(2) The rapid pace of advancements in digital image processing could render the literature review obsolete if it fails to keep pace with the latest developments.
(3) The threat of plagiarism or academic misconduct could undermine the integrity of the literature review, particularly if the authors fail to properly attribute sources or engage in unethical practices.

9. SUGGESTIONS FOR FURTHER RESEARCH FOR IDENTIFIED RESEARCH PROBLEM/TOPIC :

Explore the potential of hybrid approaches that merge the strengths of conventional image processing techniques with the advanced capabilities of deep learning methods. Research Could Focus on Developing Novel Algorithms That Leverage Handcrafted Features Along with Learned Representations from Deep Neural Networks to Enhance the Performance and Interpretability of Image-Processing Tasks. Explore Techniques for Enhancing the Explainability and Interpretability of Deep Learning Models in Digital Image Processing. Research In This Area Could Involve the Development of Visualization Methods, Attention Mechanisms, Or Model-Agnostic Explanation Techniques to Provide Insights into The Decision-Making Process of Complex Deep-Learning Models. Investigate Techniques for Developing Real-Time and Resource-Efficient Digital Image Processing Solutions Suitable for Deployment in Resource-Constrained Environments, Such as Edge Devices, IoT Sensors, Or Mobile Platforms. Research Could Focus on Algorithm Optimization, Hardware Acceleration, Or Distributed Processing Strategies to Improve the Efficiency and Scalability of Image Processing Systems. Invest In Education and Outreach Efforts to Raise Awareness and Build Capacity in Digital Image Processing Research and Applications. This Could Involve Developing

Educational Resources, Organizing Workshops and Tutorials, And Government Agencies to Support the Training and Professional Development of Researchers and Practitioners in The Field.

10. CONCLUSION :

The review emphasizes the substantial progress made in digital image processing methods over recent years. Researchers have advanced from traditional techniques to cutting-edge deep learning methods, which have significantly improved image recognition accuracy and efficiency. Deep learning has emerged as the predominant approach in image recognition, surpassing conventional techniques in numerous aspects. Convolutional Neural Networks (CNNs) and other deep learning architectures have effectively extracted intricate image features, contributing to cognitive applications' success. The journal reviews various practical applications of digital imaging techniques, such as medical image analysis, autonomous vehicles, security and surveillance, and augmented reality. These technologies have a positive impact on society, healthcare, and industry, offering potential for continued growth. This includes developing new architectures, addressing transparency issues in deep learning models, optimizing processing algorithms, and focusing on ethical considerations to ensure responsible implementation.

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