# CLASSIFICATION AND SEPARATION OF DIGITAL IMAGES USING CNN ALGORITHM

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**Abstract:** In today's digital era, managing the abundance of images shared on messaging platforms like WhatsApp can be overwhelming. This project introduces a solution using Convolutional Neural Networks (CNNs) to classify and organize these images automatically. By allowing users to upload image datasets, preprocess, and train the CNN model, the system streamlines the process of image classification. Users can visualize training progress, view accuracy metrics, and interpret confusion matrices to gauge the model's performance. Furthermore, the system extends its utility by enabling users to classify new images, simplifying the organization of study materials, notices, and other content. Ultimately, this project demonstrates the power of machine learning in enhancing efficiency and user experience in managing digital image content on messaging applications.

## 1. INTRODUCTION

Classifications are systematically divided into groups and categories based on their characteristics. Image classification has emerged to narrow the gap between computer vision and human vision by training computers with data. Image classification is achieved by classifying images into predetermined categories based on the content of the vision. Motivated by this, this article describes the study of image classification using deep learning. Traditional image classification methods are part of the field of artificial intelligence (AI), formally known as machine learning. Machine learning consists of a feature extraction engine that extracts important features such as edges and textures and a classification engine that classifies based on the extracted features. The main limitation of machine learning is that it can be separated, but it can only extract specific features on the image, not characteristic features from the training dataset. This shortcoming is eliminated by using deep learning. Deep learning (DL) is a subfield of machine learning that can be learned by a unique calculation method. Deep learning models have been introduced to permanently decompose information in a homogeneous structure that humans encounter. To achieve this, deep learning uses a hierarchical structure of multiple algorithms, represented as an artificial neural system (ANN). ANN's architecture is simulated using the biological neural network of the human brain. Image classification involves the process of categorizing digital images into predefined classes or categories based on their visual content. It enables the automated labeling of images, facilitating easier retrieval and organization. On the other hand, image separation focuses on segmenting or partitioning images into different groups or clusters based on specific attributes or characteristics. This introduction sets the stage for exploring the methodologies, techniques, and applications of ML in the classification and separation of digital images, highlighting its significance in addressing the challenges posed by the ever-growing volume of digital imagery in our interconnected world.

## 2. LITERATURE SURVEY

2.1. Title: “A Review of Image Classification and Object Detection on Machine Learning and Deep Learning Techniques” Year: 2023 Authors: Ms. R.S. Sandhya Devi, V.R. Vijay Kumar, P. Sivakumar Description: This paper explores classical machine learning and advanced deep learning methods for image classification, with a focus on Convolutional Neural Networks (CNNs). It demonstrates waste object detection using hierarchical CNNs, leveraging open-source tools like TensorFlow and Spyder for implementation.

2.2. Title: “Deep Learning Algorithm for Brain Tumor Detection and Classification using MRI Images” Year: 2023 Authors: A. Harshavardhan, N. Uma Maheswari, M. Prakash, Naresh Sammeta Description: This research presents an automated method for brain tumor detection on MRI scans, combining a Fast R-CNN (FRCN) with a Support Vector Machine (SVM). It achieves nearly perfect accuracy, close to 100%, in differentiating normal and diseased brain tissues, demonstrating the effectiveness of the approach.

2.3. Title: “Machine Learning Techniques for Image Classification: A Review” Year: 2021 Authors: Ashok Kumar Bhandari and Anil Sharma Description: This review explores machine learning methods for image classification, covering traditional approaches like support vector machines and decision trees, alongside deep learning methods such as convolutional neural networks. It underscores the significance of transfer learning, particularly in scenarios with limited labeled data, showcasing strategies like feature extraction and fine-tuning with pre-trained models from datasets like ImageNet.

2.4. Title: "Semantic Image Segmentation for WhatsApp Media Organization" Year: 2021 Authors: T. Kumar et al Description: The paper proposes semantic segmentation techniques using convolutional neural networks (CNNs) to organize WhatsApp media content. By classifying images pixel by pixel, descriptive tags like "people," "nature," and "objects" are assigned, facilitating efficient search and retrieval. Smart albums or folders automatically group images based on content, enhancing user experience by eliminating manual sorting efforts.

2.5.Title:"Privacy-Preserving Image Classification for WhatsApp" Year: 2021 Authors: G. Li and H. Wang Description: The study focuses on privacy-preserving image classification on WhatsApp by implementing algorithms directly on users' devices. By processing images locally, sensitive data stays on the device, enhancing privacy. Secure model updates within WhatsApp are ensured through techniques like federated learning or differential privacy, maintaining individual data privacy while improving models.

2.6. Title: "Automatic Image Classification for WhatsApp Media Management" Year: 2020 Authors: J. Smith et al Description: The research proposes an automatic image classification system tailored for WhatsApp media management, combining traditional and deep learning methods. Integrated into WhatsApp, the system categorizes images upon upload, facilitating instant organization into predefined categories like "family" or "landscapes." Users can further personalize organization by creating custom tags or selecting from a predefined list, simplifying media search and management within WhatsApp.

2.7. Title: "WhatsApp Media Classification using Transfer Learning" Year: 2019 Authors: R. Patel and A. Shah Description: The study explores transfer learning in WhatsApp media classification, assessing pre-trained deep learning models' adaptability for feature extraction, classification. Different strategies like fine-tuning, feature extraction are compared, aiming to enhance WhatsApp's image categorization into user-specific contexts like "family" or "vacation." WhatsApp can effectively tailor image classification to users' preferences and contexts.

2.8. Title: "Deep Learning-based WhatsApp Image Tagging" Year: 2019 Authors: F. Zhang and Q. Liu Description: Introducing a deep learning-based tagging system, this research automates the process of tagging WhatsApp images based on their content, facilitating better organization and retrieval. allow users to confirm or correct the generated tags, and use this feedback to fine-tune the deep learning model, ensuring more accurate and personalized image tagging within WhatsApp.

2.9. Title: "Content-Based Image Classification for whats App Media Organization" Year: 2018 Authors: K. Gupta and R. Sharma Description: This work focuses on content-based image classification for organizing WhatsApp media. It explores various feature extraction methods, including color histograms, texture features, and deep learning-based representations. The study compares the performance of different classifiers, such as SVM, k-NN, and decision trees, for WhatsApp image classification. This approach enables automatic organization of WhatsApp media into clusters or albums, facilitating efficient browsing and retrieval for users.

2.10. Title: "WhatsApp Image Filtering using Ensemble Learning" Year: 2018 Authors: P. Singh and N. Gupta Description: Focusing on image filtering, this research proposes an ensemble learning approach to filter out inappropriate images shared on WhatsApp, enhancing the platform's safety and usability. Implement a voting mechanism within the ensemble model to determine the final classification decision for each image. This could involve techniques such as simple majority voting or weighted voting to aggregate predictions from individual classifiers and enhance the accuracy of image filtering on WhatsApp.

## 3. EXISTING SYSTEM

Our system will operate according to the system architecture depicted in the diagram below, capturing images either through a digital camera or through a database. For the next step, each image will be normalized to a predetermined size. We employ feature extraction approaches such as M-BTC (Block Transition Coding), Histogram Equalization, and others to reduce dimensionality. Feature vectors are formed by extracting features from a picture using various approaches such as MBTC (Block Transition Coding),Histogram Equalization, and so on. The NN will be given this processed image to use in the classification process.

DISADVANTAGES:

- The dataset used for training may not fully capture the diversity of WhatsApp images.
- Variations in image quality across devices can impact performance.
- ML models analyze images solely based on visual content, ignoring contextual information like conversation context or intent.
- Extracted features may not capture all relevant information, affecting performance, especially for complex image types.
- Manual labeling of images for training is time-consuming and error-prone.
- Ensuring the accuracy and consistency of labels across diverse images is difficult. Handling personal or sensitive information in images raises ethical and privacy concerns.
- Ensuring user consent, data protection, and privacy compliance is essential.
- Models trained on biased data may exhibit unfair behavior, disproportionately misclassifying images from certain groups.

## 4. PROPOSED SYSTEM

In this project we are using CNN (convolution neural networks) algorithm to classify Digital images to different categories such as Question Paper, Mark sheets, Printed papers, hand written papers and circular. CNN algorithm will get trained on above mention categories to build a

classification model. This model can be applied on test images to predict image type. 7 Folder Creation and Image Classification in Upon running the script, the system will create separate folders for different types of images, such as handwritten notes, printed notes, screenshots, brochures, etc. It will then classify each image based on its content and move them to the respective folders accordingly.

ADVANTAGES

• GUI Integration utilizes Tkinter, a standard GUI toolkit for Python, to create an intuitive graphical user interface. This allows users to interact with the application seamlessly, upload datasets, initiate preprocessing, train the CNN model, visualize training graphs, classify images, and exit the application conveniently.

• Efficient Image Processing leverages OpenCV and PIL libraries for efficient image processing tasks such as reading, resizing, converting, and saving images. These libraries offer a wide range of functionalities for handling digital images effectively.

• Deep Learning Integration integrates Keras, a high-level neural networks API, for building and training Convolutional Neural Network (CNN) models. CNNs are well-suited for image classification tasks and can achieve high accuracy when trained on appropriately prepared datasets.

**SYSTEM ARCHITECTURE**

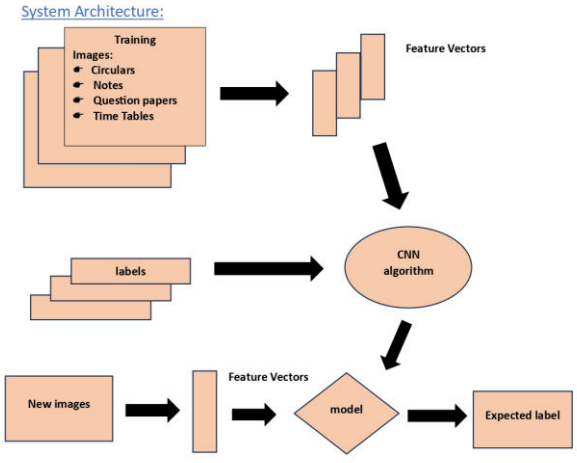


Fig: System Architecture

**5. UML DIAGRAMS**

**1. CLASS DIAGRAM**

Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application. Class diagram describes the attributes and operations of a class and also the constraints imposed on the system. The class diagrams are widely used in the modeling of object oriented systems because they are the only UML diagrams, which can be mapped directly with object-oriented languages. It is also known as a structural diagram. Class diagram contains • Classes • Interfaces • Dependency, generalization and association.

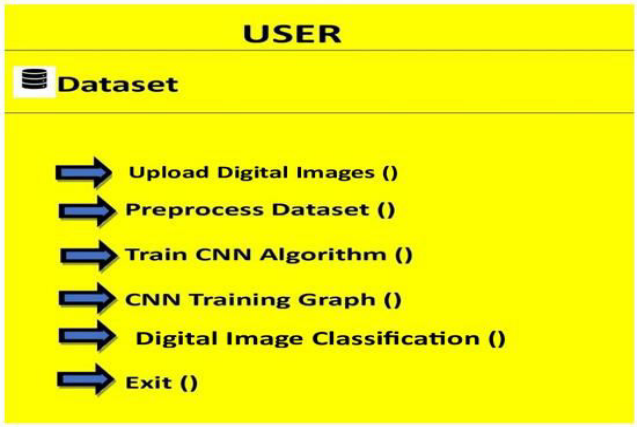


Fig 5.1 shows the class diagram of the project

**2. USECASE DIAGRAM:**

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted

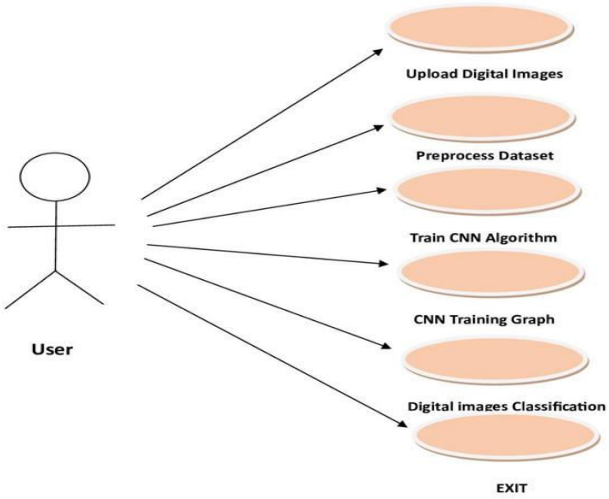


Fig 5.2 shows the Use case Diagram

**3. SEQUENCE DIAGRAM:**

A sequence diagram simply depicts interaction between objects in a sequential order i.e. the order in which these interactions take place. We can also use the terms event

diagrams or event scenarios to refer to a sequence diagram. Sequence diagrams describe how and in what order the objects in a system function. Sequence diagrams are used to formalize the behavior of the system and to visualize the communication among objects. These are useful for identifying additional objects that participate in the use cases. These diagrams are widely used by businessmen and software developers to document and understand requirements for new and existing systems.

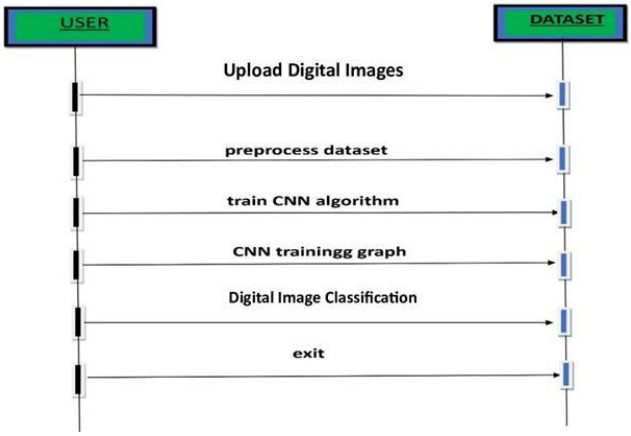


Fig 5.3 Shows the Sequence Diagram

## 6. RESULTS

6.1 Output Screens

To run the project double click on the 'run.bat' file to get below screen

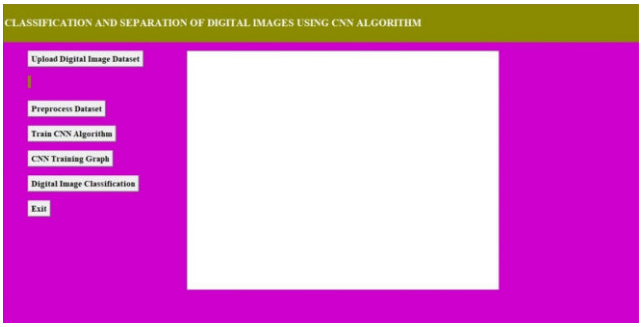


Fig 6.1 Home Page

In the above screen click on the 'Upload Digital Image Dataset' button to upload the dataset and get below page

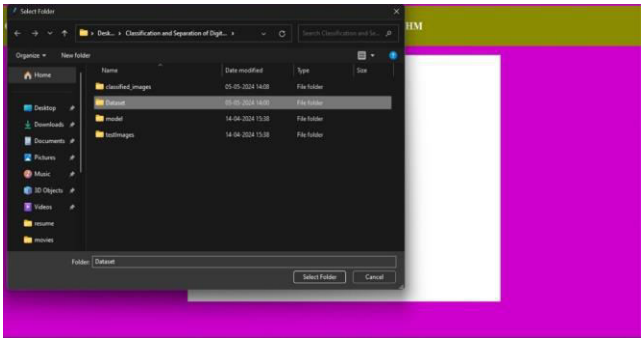

Fig 6.2 Upload Dataset

In above screen selecting and uploading 'Dataset' entire folder and then click on 'Select Folder' button to load dataset and get below page. In above screen we can see dataset loaded and then we can see types of categories loaded and now click on 'Preprocess Dataset' button to resize, normalize, shuffle and split dataset into train and test.

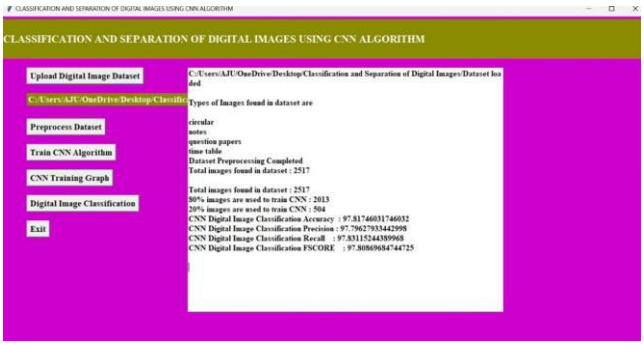


Fig 6.3 Accuracy of CNN Algorithm

In the above screen we can see application found a total 2517 images in the dataset and then processed and then took 2013 images for training and 504 images for testing 80% and 20%. Now click on 'Train CNN Algorithm' button to train CNN and get below output.

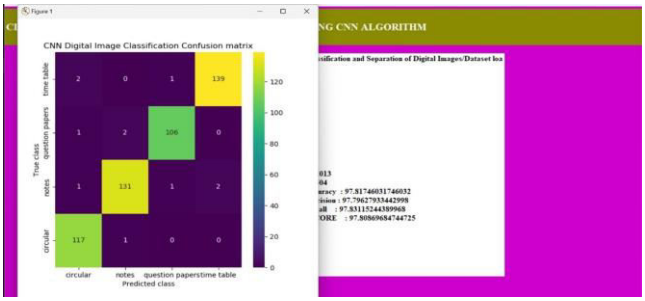


Fig 6.4 Confusion Matrix of CNN Accuracy matrix for sentiment analysis.

Then click on "CNN Training Graph" button to see the training accuracy and loss graph and later click on "Digital Image Classification" button to select the required or all images to classify and separate them. Below figure shows the selection of digital images.

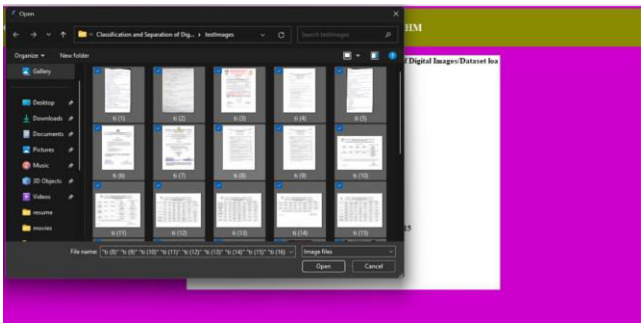

Fig 6.5: Selection Of Digital Images

After selection of digital image(s) click the button “open” then the application will automatically classifies the digital images and saves the digital images in “classified_images” folder in their respective folders that they belongs to, which is shown in below figure.

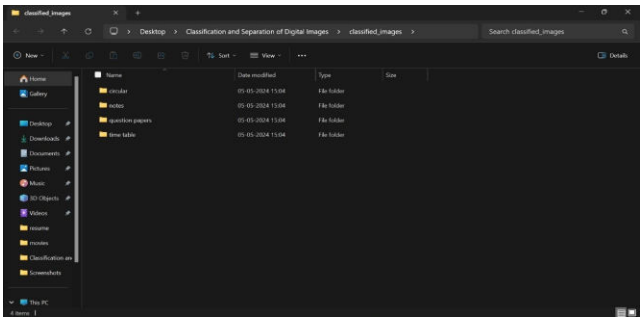

Fig 6.6: Digital Image Classification

## 7. CONCLUSION

In conclusion, our project showcases the potential of machine learning, specifically Convolutional Neural Networks (CNNs), in automating the classification and organization of digital images. By leveraging advanced algorithms, we have developed a system capable of accurately categorizing diverse digital images, enhancing user productivity and experience within messaging applications. Through comprehensive evaluation metrics and visualization tools, users gain insights into the model's performance, ensuring reliable classification results. Moreover, the project's scalability and adaptability allow for potential integration into other digital platforms, extending its utility beyond the scope of messaging applications. Overall, our project demonstrates the transformative impact of machine learning in streamlining image management processes and paving the way for future advancements in digital content organization.

## FUTURE SCOPE

The future scope of our project includes several avenues for further enhancement and expansion. Firstly, we aim to explore techniques for improving the CNN model's accuracy and robustness, including experimenting with different architectures and optimization algorithms. Additionally, extending the classification capabilities to encompass a broader range of digital image types would enrich the system's functionality and applicability. Integration with other messaging platforms and digital repositories could broaden its utility and reach. Moreover, enhancing the user interface with features like batch processing and customization options would improve user experience. Furthermore, incorporating real-time updates and notifications for newly classified images could enhance the system's responsiveness. Finally, exploring the potential for multi-language support and scalability to accommodate larger datasets would further solidify the project's relevance and applicability in diverse contexts.

## 8. REFERENCES

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