Deep Learning Based Drug Abuse Detection and Classification Using Iris Scanning

Shama[1], Usha G M[2], Usha Rani S[3], Varsha U K[4], Abhijith L Kotian[5].
[1,2,3,4,5]Department of Computer Science and Engineering, AIET, Mijar, Dakshina Kannada, India
Shamakulal10@gmail.com[1], ushagmusha@gmail.com[2], usharaniusha014@gmail.com[3], varshauk29@gmail.com[4], abhijithlkotian@gmail.com[5]

Abstract—**The problem of drug abuse is one that will never go away and requires creative methods for prompt detection and treatment. The accuracy, efficiency, and privacy oftraditional screening methods are often compromised, making them ineffective. With a particular focus on iris image analysis, this study investigates the potential of convolutional neural networks (CNN) in drug addiction detection. The objective is toidentify drug-induced physiological changes from ocular pictures by employing CNN's predictive analysis skills. Ourapproach, which includes preprocessing, data segmentation, CNN training, and performance evaluation, is based upon a carefully selected dataset of drugged and non-drugged eye pictures that were obtained lawfully and with stringent privacy rules. Creating a dependable system that can identify between drugged and non-drugged eyes based just on iris images is the main goal of the research. This project attempts to improve drug misuse detection by the integration of state-of-the-art technology with strict procedures, potentially changing screening and intervention processes. The approach is described in depth upcoming sections, along with preprocessing methods, data segmentation, CNN design, model assessment, and research implications. The goal of this initiative is to significantly impact the fight against drug misuse and the negative effects it has on society.**

Keywords: Drug abuse detection, Iris images, Convolutional Neural Networks(CNN), Deep learning, Image preprocessing.

I. INTRODUCTION

THE drug misuse is a widespread problem that presents a variety of difficulties that call for creative methods for early detection and intervention. The accuracy, efficiency, and privacy of traditional screening methods are often compromised, making them ineffective. Our research uses cutting-edge technology, specifically Convolutional Neural Networks (CNN), to detect drug addiction.

The CNN's ability to do predictive analysis on ocular pictures forms the basis of our methodology. A potential application for biometric identification and the detection of drug-induced physiological alterations is the uniqueness in patterns present in iris samples. Our methodology involves four important stages: preprocessing image data, segmenting datasets, CNN training model, and assessing performance metrics [1]. It leverages a carefully selected dataset of drugged and non-drugged eye pictures obtained lawfully and with strong privacy requirements.

Our mission is unambiguous: to create a robust system that uses iris pictures alone to discriminate between eyes that have been drugged and those that have not. We hope to improve drug misuse detection with state-of-the-art technology and meticulous methods, which could change screening and intervention procedures.

The approach we used—which includes data segmentation, CNN design, preprocessing methods, model evaluation, and implications for future research—will be covered in depth on following sections [24,25]. With this project, we hope to significantly lessen drug usage and relevant social consequences that effect the societal behaviors.

II. REVIEW OF RELATED STUDIES

Pyingkodi M et al [1] proposed in their paper “Drug consumption detection by eye using image processing techniques" an image processing-based approach that detects drug use in the eye through segmentation, identifying reddish dots, and categorization with training. That aims to mitigate economic losses by discerning drug influence in authorized individuals, enhancing drugged eye detection efficacy.

Alae Eddine El Hmimdi et al [2] proposed in their paper "Deep Learning-Based Detection of Learning Disorders on a Large-Scale Dataset of Eye Movement Records" an automated approach using machine learning to detect drug influence in eyes. Employing a dataset of drugged and non-drugged eye images, they utilized CNNs for classification, achieving promising results in identifying drug-induced physiological changes.

Rony Sayres et al [3] proposed in their paper " Artificial intelligence, machine learning and deep learning for eye care specialists " that offers an overview of biometric techniques, including iris scanning, for drug abuse detection. It discusses their strengths, weaknesses, and current research gaps, suggesting avenues for future investigation.

Nagalaxmi et al [4] proposed in their paper "Conjunctivitis eye detection and personalized drug recommendation system using CNN " a deep learning approach for drug abuse detection based on iris images. Through experimentation with various CNN architectures and pre-processing techniques, they demonstrated the potential of deep learning in accurately detecting drug influence.

Garcia et al [5] proposed in their paper "Iris-based drug detection system utilizing ML algorithms" by using this they developed an iris-based drug detection system leveraging machine learning algorithms. Their experiments on a database of drugged and non-drugged iris images yielded accurate results in drug detection, showcasing the effectiveness of ML in this domain [26].

III. OBJECTIVES AND MOTIVATION

Our intention is to use state-of-the-art image processing techniques to create a system that can reliably and accurately identify drug effects in the eyes. Our goal is to efficiently and precisely classify eye images into groups that are drugged or not using drugs by utilizing Convolutional NeuralNetworks (CNNs) [2].

Key Objectives:

- Create an automated model that uses different kinds of image processing methods to identify drug influence in the eyes.
- A CNN what we call as Convolutional Neural Network can be used to effectively classify drugged and non-drugged eye pictures.
- For effective drug detection, implement a workflow that includes preprocessing, train-test split, training, and model selection.
- Analyze the suggested accuracy, precision as the main system's performances
- Examine the possible financial advantages of precise drug detection, such as a decrease in losses from drug-influenced persons.

Our project aims to improve public safety and well-being while reducing the societal burden of drug misuse. It addresses the pressing need for effective drug abusedetection by developing a precise system for diagnosing druginfluence in eyes using modern image processing and CNNs [9].

Key Motivations:

- Concerns about Public Health: Substance misuse presents serious threats to both personal health and public safety, highlighting the importance of precise detection techniques.
- Technical Innovation: Using CNNs and sophisticated image processing methods presents a chance to create novel drug detection systems, expanding the frontiers of public health technology.
- Healthcare Support: Ensuring that those who are into drug abuse receive timely aid and intervention can be achieved through early detection of drugusage [27]. By identifying signs of drug influence through ocular scans, medical professionals can givethose in need the right kind of support and therapy.
- Increasing Awareness: You can inform individuals about the dangers and prevalence of drug abuse by
- Implementing a reliable drug detection system [22,23]. By showcasing how technology implementation detects the drug effectively, this study can educate the public and encourage proactive measures to lower substance usage.

IV. SYSTEM ARCHITECTURE

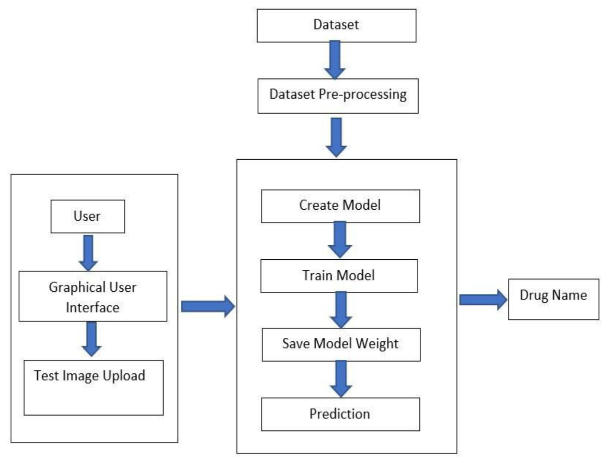

Fig.1.System Design.

The layout of the suggested system is depicted in theabove diagram. Web applications are used by users to interact with the system. The model built using deep learningwill analyses and classify each test image that is uploaded. The creation, training, saving considering model weight, andclassification are the four primary functions of the deep learning module [1]. A dataset is downloaded from the Internet and enhanced using various augmentation techniques, including scaling, zooming, and rotation, in orderso generate additional copies of the dataset required for the proposed system. By extracting features from images, a CNN model is constructed trains system [8]. Utilizing test images, the DL model forecasts the kind of drug ingestion.

V. PSEUDO CODE OF DESIGNED SYSTEM

Step 1: Collect dataset
Step 2: Pre-process dataset
    Import libraries/modules
    For every image in dataset:
        Read a image from dataset using imread()
        Resize the image using resize()

Perform Image augmentation using
ImageDataGenerator()
images into images[]
Append labels into labels[]
End for
Step 3: Build Model
Create a CNN Model
Add an input layer of size (150,150)
Add convolution, pooling, dense layer
Step 4: Train Model
Split the dataset into training set and test set in 90:10 proportion
Configure training parameters (batch size, number of epoch)
Step 5: For I in range(epoch)
For image in training set(X_test):
Extract feature
Add corresponding labels (Y_test)
Evaluate the training accuracy and validation accuracy
If model accuracy < 90
Adjust model parameter
Repeat Step 5
Else:
Break;
Step 6: Save model weight in .h5 file

VI. System Implementation

The effective implementation of a new innovative system is a critical stage in the system development life cycle. To put a new system design into operation is to implement it [3].The word "implementation" is synonym of tasks, from the conversion of a simple programme to the total replacement of a computer system. Here, "implementation" considers the process of turning a newly created or implemented design into a functional one.

A. Algorithm Used

The project employed the following algorithm:

- Convolution Neural Network (CNN)

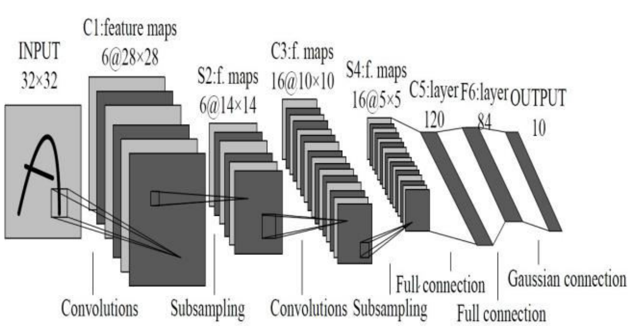

Fig.2.CNN.

Among the representative algorithms in deep learning is the convolutional neural network. For the intention of having achieving an input-to-output mapping, it functions essentially as a multi-layer perceptron replicates local perception. By utilizing multiple convolutions and pooling, it extracts the property present on the data at various sizes [4]. The manner that shared weights and local connections are using the CNN network is distinctive. Reducing the no's weights minimizes the likelihood of overfitting while also making the network easier to tune. CNNs are often made using three levels: convolutional, pooling, fully linked, and SoftMax, which are mutually supportive of one another. We obtain local features throughout the convolution procedure [19,20,21]. Multi-level cascadingis used in the calculation process to extract more complex feature correlation values from low-level convolutional layers, since the convolution layers is made up of multiple convolution units. This allows for the extraction of more features about the input parameters [16].

B. Dataset Overview

The dataset is consisting of several ocular images which has to be carefully selected to ensure diversity and representativeness. It includes both drugged and non-drugged examples. Pre-processing is applied to each imagein order to maximize performance during model training andevaluation by enhancing features and removing noise. The dataset respects individuals' rights and anonymity by adhering to stringent privacy standards, which priorities ethical considerations [15]. Comprehensive data investigation and analysis yields insights into drug-induced physiological changes in the eye, which guide the development and improvement of the detection system.

1) Example Samples:

- Normal eye images

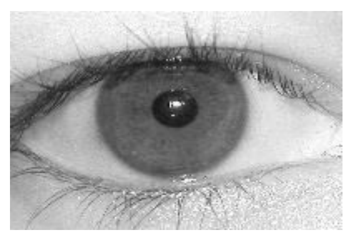

Fig.3.Normal eye sample 1.

Fig.4.Normal eye sample 2.

- Drugged eye images

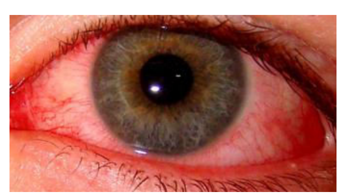

Fig.5. Drugged eye sample 1.

Fig.6. Drugged eye sample 2.

C. Workflow

The suggested system comes into action by taking the subsequent actions.

1) Pre-processing

Specifics Pre-processing is one way to turn the raw data into a clean data set. Stated differently, data that is collected in raw form from several sources is not suitable for analysis. Pre-processing is applied resize the photographs in the dataset [10]. We generated newest of dataset using user signatures, and before doing any additional processing, we downsized the images to 150 by 150.

2) Train Test Split

Classification of data is the step of splitting it up intogroups and classes according to specific features. Classification facilitates comparisons between observational categories. Either qualities or numerical characteristics must have be usd to determine it [5,6]. Here, the prepared data must be visualized in order to determine whether the trainingdata—also seen as a target or target attribute—contains the proper label. Ten samples is kept aside for testing and training uses the rest ninety samples in this project [17].

3) Training

ML algorithms, also known as learning algorithms, are trained by feeding them training data. This is the method of creating an ML model. An artefact produced during training is known as a machine learning model (ML model) [8]. It is essentially the training data to include the right response, also called as a target or target characteristic. The learning process creates an ML model that is capable of identifying patterns in the training data that relate the qualities of the input data to the target, or the desired prediction [14].

4) Picking the Model

The procedure for pickling involves saving the model in a file for later usage [7]. Data won't be trained after the pickling model; hence it is imperative that the model be properly trained and optimized before picking. Every time a user makes a categorization, pickling eliminates the requirement to train the model.

VII. Code Implemented

The snippets of code applied on the project are listed below.

A. Importing required packages

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import os
import cv2
from tqdm import tqdm
import random as random
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from keras.utils import to_categorical
from keras.layers import Dense,Dropout,Flatten,Conv2D,MaxPool2D,BatchNormalization
from keras.models import Sequential
from keras.losses import categorical_crossentropy
from keras.optimizers import Adam
from keras.preprocessing.image import ImageDataGenerator
```

B. Pre-processing the dataset images

```
imagegen = ImageDataGenerator(featurewise_center=False,
                              samplewise_center=False,
                              featurewise_std_normalization=False,
                              samplewise_std_normalization=False,
                             rotation_range=60,
                              zoom_range=0.1,
                              width_shift_range=0.1,
                              height_shift_range=0.1,
                              shear_range=0.1,
                              fill_mode='reflect')
```

C. Splitting Dataset and Training

```
X_train,X_valid,y_train,y_valid = train_test_split(X,y,test_size=0.1,random_state=42)

batch_size = 64
epochs = 10
num_classes = y.shape[1]
```

D. Prediction

```
model = model_from_json(loaded_model_json)


model.compile(optimizer='adam', loss='binary_crossentropy',
                metrics=[categorical_accuracy])

model.load_weights(os.getcwd() + "\\trained_material_model.h5")
model.compile(optimizer='adam', loss='binary_crossentropy',
              metrics=[categorical_accuracy])


score = model.predict(X)
```

VIII. MODEL ACCURACY

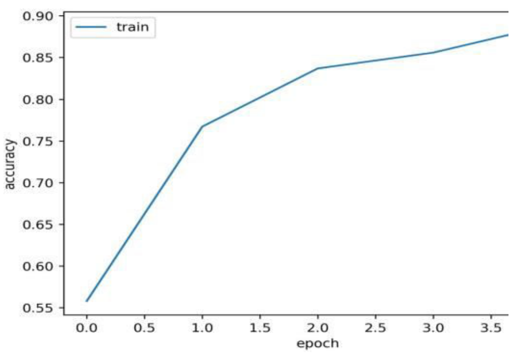

Fig.7. Model Accuracy.

The model's final accuracy might be as high as 0.90, meaning that on the test dataset, it accurately predicts whether or not an eye picture is drugged 90% of the time. Itsa kind of positive finding, suggesting that the CNN model has successfully distinguished between drugged and non-drugged eye pictures and has identified significant patterns from the input data [14].

IX. SOFTWARE USED

B. Python

The general-purpose, interpreted programming language Python is at a high level. Use of substantial indentation is part of its design philosophy, which prioritizes code readability. Instead of using curly brackets or keywords to separate blocks, Python employs whitespace indentation. Anasterisk (-) denotes completion current block; an asterisk (-) follows some statements. The visual layout of programme sofaithfully reflects its semantic structure. Sometimes this characteristic is seen as the off-side rule. Indentation has no semantic meaning in most languages, but its uses are in a few others. Indenting four spaces is the ideal size.

C. Django-Python Web Framework

The MTV architectural pattern is used by the free and open-source Django web framework, which is based on Python. The Django Software Foundation (DSF), a separate, US-based non-profit organization, is responsible for maintaining it [12,13]. Creating sophisticated, database- driven websites should be made easier using Django.

The framework places a strong emphasis on the ideas of don't repeat yourself, fast development, minimum coupling, reusability, and "pluggability" of components. Even for the files, settings, and data models, Python is used throughout. In addition, Django offers an optional administrative create, read, update, and delete interface that is defined via admin models and dynamically produced through introspection.

D. Keras

A Python having an interface for ANN is offered by the Keras library with open-source (os) software. The TensorFlow library is interfaced with by Keras. Its main goals are to be extendable, modular, and user-friendly in order to facilitate quick experimentation with deep neural networks. Google engineer François Chollet is the principal author and software is looked after by them, which was created as a component of the ONEIROS (Open-ended Neuro-Electronic Intelligent Robot OS) research project[18].

E. Visual Studio Code

A code editor for IntelliSense and code refactoring is included with Visual Studio. The integrated debugger functions as a machine-level and source-level debugger. Additional integrated tools comprise a code profiler, a web designer, a class designer, a database schema designer, and a designer for creating GUI applications.

It takes plug-ins to extend its functionality to nearly any extent. For example, it can support source control systems (like Git and Subversion) and add new toolkits for domain-specific languages, such as editors and visual designers, or it can accept toolkits for other stages of the software development lifecycle, such as Team Explorer from the Azure DevOps client. The Community edition of VisualStudio is the most basic version and is free of cost.

F. HTML

The standard markup language basically used for building webpages and webapps is called HTML. It is one ofthe three core technologies of the World Wide Web, together with JavaScript and Cascading Style Sheets. HTML documents can be downloaded locally or from a webserver, and web browsers use these to create multimedia webpages [12]. Semantically describing a web page's structure, HTML initially contained signals for the document's appearance.

G. JavaScript

High-level, interpreted JavaScript (often shortened to JS) is a programming language that follows the ECMAScript standard. It is a prototype-based, multi-paradigm, dynamic, weakly typed programming language. One of the fundamental technologies of the World Wide Web, along with HTML and CSS, is JavaScript. JavaScript is a crucial component of online applications and allows for interactive web pages. It is used by the great majority of websites, and the main web browsers have a special JavaScript engine to run it.

H. Back End: My-SQL

The most used open-source relational database management system (RDBMS) in the world as of July 2013 is MySQL, also known by its nickname "My Sequel." MySQL is the official name of the database management system.

X. Conclusion

By the deployment of CNN favorable results been generated for drug prediction utilizing drugged and non-drugged eye pictures. The model has achieved impressive accuracy levels. A strong predictive architecture can reliably identify drug influence in eye images has been developed thanks to the organized workflow, which includes pre-processing, train-test split, training, and model selection. Although these results highlight the potential for useful application in drug screening programmes, more work is needed to improve the model's architecture, increase its dataset, and address ethical issues in order to ensure responsible deployment of the model in real-world settings and further increase its efficacy.

XI. References

[1] Pyingkodi M, Thenmozhi K, Wilfred Blessing, Archana K, Arun hiruthik, Dinesh Kumar, "Drug consumption detection by eye using image processing techniques", 2023 International Conference on Computer Communication and Informatics (ICCCI), 2023.

[2] Alae Eddine El Hmimdi, Zoï Kapoula, Vivien Sainte Fare Garnot , "Deep Learning-Based Detection of Learning Disorders on a Large Scale Dataset of Eye Movement Records", BioMedInformatics 2024, vol 4, pp 519–541. [Online]. Available: https://doi.org/10.3390/biomedinformatics4010029

[3] Rory Sayres and Naama Hammel and Yun Liu, "Artificial intelligence, machine learning and deep learning for eye care specialists", Annals of Eye Science, vol 5,2020, [Online]. Available:https://aes.amegroups.org/article/view/5371.

[4] N Nagalaxmi N,H Sridevi ,"Conjunctivitis eye detection and personalized drug recommendation system using CNN" , International Journal of Creative Research Thoughts, (IJCRT) 2023

[5] A. K. Jain, D. Deb, and J. J. Engelsma, "Biometrics: Trust, butverify," CoRR, vol. abs/2105.06625, 2021. [Online]. Available: https://arxiv.org/abs/2105.06625.

[6] K. Richter, L. Peter, A. Rodenbeck, H. Weess, S. Riedel Heller, and T. Hillemacher, "Shiftwork and alcohol consumption: A systematic review of the literature," Eur Addict Res, vol. 27, pp. 9–15, 2021.

[7] A. Kumar and A. Passi, "Comparison and combination of iris matchers for reliable personal authentication," Pattern Recognition, vol. 43, no. 3, pp. 1016 – 1026, 2010.

[8] A. Czajka, "Pupil dynamics for iris liveness detection," IEEE Transactions on Information Forensics and Security, vol. 10, no. 4, pp. 726–735, 2015.

[9] G. Koukiou and V. Anastassopoulos, "Eye temperature distribution in drunk persons using thermal imagery," in 2013 International Conference of the BIOSIG Special Interest Group (BIOSIG), Sep. 2013, pp. 1–8.

[10] National Sleep Foundation. Facts about shift work disorder; 2018. [Cited 2018 Jul 1]. Available from: https://sleepfoundation.org/shiftwork/content/facts-about shift-work-sleep-disorder.

[11] Boisard P, Cartron D, Gollac M, Valeyre A. Temps et travail: la durée du travail. Dublin: European Foundation for the Improvement of Living and Working Conditions; 2002.

[12] M. S. Hossain1, R. M. Mou1, M. M. Hasan2, and S. Chakraborty1, "Recognition and Detection of Tea Leaf's Diseases Using Support Vector Machine." IEEE 14th International Colloquium on Signal Processing & its applications, 2018. doi: 978-1-5386-0389-5/18/$31.00 ©2018 IEEE.

[13] G. Liu, W. Zhou, L. Tian, W. Liu, Y. Liu, and H. Xu, "An efficient and accurate iris recognition algorithm based on a novel condensed 2-ch deep convolutional neural network," Sensors, vol. 21, no. 11. 2021. doi: 10.3390/s21113721.

[14] B. Fang and Y. Y. Tang, "Elastic registration for retinal images based on reconstructed vascular trees," IEEE Transactions on Biomedical Engineering, vol. 53, no. 6, pp. 1183–1187, 2006.

[15] K. W. Bowyer, K. P. Hollingsworth, and P. J. Flynn, "A survey of Iris biometrics research: 2008–2010," in Handbook of Iris Recognition, pp. 15–54, Springer, Berlin, Germany, 2013.

[16] S. Viriri and J. R. Tapamo, "Integrating iris and signature traits for personal authentication using user-specific weighting," Sensors, vol. 12, no. 4, pp. 4324–4338, 2012.

[17] A. K. Jain, S. S. Arora, K. Cao, L. Best-Rowden, and A. Bhatnagar,"Fingerprint recognition of young children," IEEE Transactions on Information Forensics and Security, vol. 12, no. 7, pp. 1501–1514, 2016.

[18] K. Bonnen, B. F. Klare, and A. K. Jain, "Component-based representation in automated face recognition," IEEE Transactions on Information Forensics and Security, vol. 8, no. 1, pp. 239–253, 2012.

[19] Abhijith L Kotian, Deepa K, "Detection and Classification of Skin Diseases by Image Analysis Using MATLAB", International Journal of Emerging Research in Management & Technology, ISSN: 2278-9359 (Volume-6, Issue-5),pp.779-784, 2017.

[20] Abhijith L Kotian, Madhura KJ, Rahul PT, "Machine Learning Based Melanoma Skin Cancer Detection", International Journal of Engineering Management and Humanities, Volume 4,issue 3,pp 72-76,2023.

[21] Abhijith L Kotian, Prinson D'Souza, Swasthik Suvarna, Upasana Shenoy , Vaibhav SSoorinje, "Covid-19 Verification and Supply Chain Management", International Journal of Engineering Management and Humanities, Volume 4, issue 3,pp 1-6, 2023.

[22] S. Minaee and Y. Wang, "Palmprint recognition using network,"deep Proceedings scattering - IEEE International Symposium on Circuits and Systems. 2017. 10.1109/ISCAS.2017.8050421. doi:

[23] H. B. K. M, Manjunath, "Analysis of Unimodal and Multimodal Biometric System using Iris and Fingerprint." : PiCES Journal, 2018.

[24] M. G Alaslani and L. A. Elrefaei, "Convolutional Neural Network Based Feature Extraction for IRIS Recognition," Int. J. Comput. Sci. Inf. Technol., vol. 10, no. 2, pp. 65–78, Apr. 2018, doi: 10.5121/ijcsit.2018.10206.

[25] M. G Alaslni and L. A. Elrefaei, "Transfer Learning with Convolutional Neural Networks for International pp. IRIS Journal Recognition," of Artificial Intelligence & Applications, vol. 10, no. 5. 49–66, 10.5121/ijaia.2019.10505. 2019.

[26] H. K. Obayed, F. S. Al-Turaihi, and K. H. Alhussayni, "Sentiment classification of user's reviews on drugs based on global vectors for word representation and bidirectional long short-term memory recurrent neural network," Indones. J. 345, Electr. Eng. Comput. Sci., vol. 23, no. 1, p. Jul. 2021, 10.11591/ijeecs.v23.i1.pp345-353.

[27] A. S. Al-Waisy, R. Qahwaji, S. Ipson, S. Al-Fahdawi, and T. A. M. Nagem, "A multi-biometric iris recognition system based on a deep learning approach," Pattern Anal. Appl., vol. 21, no. 3, pp. 783–802, Aug. 2018, 10.1007/s10044-017-0656-1.