SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

A MINI-PROJECT REPORT

ON

"MYOPIA AND HYPERMETROPIA IMAGE DETECTION"

Submitted in partial fulfilment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

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DECLARATION

We, **OM MISHRA A(R21EJ067), MADINENI KAVYA(R21EJ063), SANJANA B(R21EJ074) and SAKSHI UPADHYE(R21EJ073)** students of B.Tech. CSIT, VI Semester, School of Computing and Information Technology, REVA University declare that the Mini-Project Report entitled "**MYOPIA AND HYPERMETROPIA IMAGE DETECTION"** done by us under the guidance of **Prof. Kasi Viswanath Gupta**, School of Computing and Information Technology, REVA University. We are submitting the Mini-Project Report in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in COMPUTER SCIENCE AND INFORMATION TECHNOLOGY by the REVA University, Bengaluru during the academic year 2023-24. We further declare that the Mini-Project or any part of it has not been submitted for award of any other Degree of REVA University or any other University / Institution.

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SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

CERTIFICATE

This is to be certified that the Mini-Project entitled "**MYOPIA AND HYPERMETROPIA IMAGE DETECTION"** carried out under my guidance for **OM MISHRA A(R21EJ067), MADINENI KAVYA(R21EJ063), SANJANA B(R21EJ074) and SAKSHI UPADHYE(R21EJ073),** bonafide students of REVA University during the academic year 2022-23. The above-mentioned student is submitting the Mini-Project report in partial fulfilment for the award of Bachelor of Technology in Computer Science and Information Technology during the academic year 2023-24. The Mini-Project report has been approved as it satisfies the academic requirements in respect of Mini-Project work prescribed for the said degree.

Signature with date **Signature with date**

Guide **Director**

Name of the Examiner **Signature with Date**

1.

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ABSTRACT

This research presents a cutting-edge approach to address the pressing need for automated myopia and hypermetropia detection through a computer vision-based system. By harnessing sophisticated image processing techniques and state-of-the-art machine learning algorithms, our proposed system meticulously analyzes retinal images to pinpoint refractive errors with high precision. Our comprehensive evaluation encompasses a wide range of datasets, showcasing the robustness and versatility of our model across various demographics and conditions. Moreover, we emphasize the pivotal role of early detection facilitated by our system in enabling timely interventions for individuals affected by vision-related disorders. The promising outcomes observed in terms of sensitivity and specificity underscore the potential of our approach to revolutionize clinical practice, paving the way for more efficient and accessible diagnosis and management of myopia and hypermetropia.

ACKNOWLEDGEMENT

We would like to express our deepest gratitude to **Dr. P. Shyama Raju,** Founder Chancellor for providing us the necessary facilities for the successful completion Mini-Project. We would also like to acknowledge **Mr. Umesh Raju**, Pro-Chancellor, **Dr. M. Dhananjay**, Vice-Chancellor, **Dr. R C Biradar,** Pro Vice-Chancellor and **Dr. N. Ramesh,** Registrar for their constant support and endorsement through invaluable administration.

In the same breath, we would also like to thank Dr. Mallikarjun Kodabagi, Director, the School of Computing and Information Technology, for his constant support and encouragement. We would like to express our deepest gratitude to **Prof. LAKSHMAN** - Program Coordinator for giving us an opportunity to take up the Mini-Project.

We wish to record our deep sense of gratitude and profound thanks to our guide Prof.**,** School of Computing and Information Technology, REVA University for his keen interest, inspiring guidance, and constant encouragement with my work during all stages, to bring the Mini-Project report into fruition.

Finally, we are thankful for the almighty, my parents, brothers, sisters, family members and friends for their moral support during our Mini-Project work.

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

Myopia and hypermetropia, prevalent eye disorders, disrupt clear vision at varying distances. Myopia, or nearsightedness, blurs distant objects, while hypermetropia, or farsightedness, blurs near objects. These conditions stem from factors such as the eye's shape, corneal curvature, or eye length. In today's global context, additional factors exacerbate vision issues, prompting the need for innovative solutions. To address these challenges comprehensively, a proposed system integrates advanced computer vision technologies and machine learning algorithms. This system offers tailored solutions to individuals experiencing vision-related difficulties, leveraging precise analysis of retinal images to detect refractive errors accurately. By providing early diagnosis and intervention capabilities, this system aims to mitigate the impact of myopia and hypermetropia on daily life, enhancing overall eye health and quality of vision for users worldwide.

CHAPTER 2
LITERATURE REVIEW

Myopia and hypermetropia, two common refractive errors of the eye, pose significant challenges to global eye health. While these conditions have long been understood in ophthalmology, recent advancements in computer vision and machine learning have sparked interest in innovative approaches to their detection and management.

Studies investigating the prevalence and epidemiology of myopia and hypermetropia have shed light on the scope of these disorders worldwide. Research by Morgan et al. (2018) highlighted the increasing prevalence of myopia, particularly in urban populations, emphasizing the urgency for effective screening and intervention strategies. Similarly, studies by Vitale et al. (2015) and Pan et al. (2015) underscored the impact of hypermetropia on visual impairment, especially among older adults.

Traditionally, diagnosing refractive errors relied on subjective refraction tests conducted by optometrists or ophthalmologists. However, the emergence of computer-based systems has revolutionized this process. Notable advancements include the work of Wong et al. (2016), who developed a computer-assisted system for myopia detection using fundus images. Their approach combined image processing techniques with machine learning algorithms to achieve high accuracy in identifying myopic changes in the retina.

In parallel, efforts have been made to address hypermetropia detection using similar methodologies. Li et al. (2019) proposed a deep learning-based system for hypermetropia detection from anterior segment optical coherence tomography images. Their model demonstrated superior performance in distinguishing hypermetropic eyes from normal eyes, offering a promising avenue for early diagnosis and intervention.

In summary, recent literature underscores the potential of computer vision-based systems for myopia and hypermetropia detection. By leveraging advanced technologies and interdisciplinary collaboration, these systems hold promise for improving early diagnosis, personalized treatment, and ultimately, the overall management of refractive errors in clinical settings.

CHAPTER 3
TOOLS AND METHODOLOGY

Tools:

1. **Image Acquisition Tools:**
- Fundus cameras
- Optical coherence tomography (OCT) scanners
2. **Image Preprocessing Tools:**
- OpenCV (Open Source Computer Vision Library)
- MATLAB Image Processing Toolbox
3. **Feature Extraction Tools:**
- MATLAB
- TensorFlow
- PyTorch
4. **Machine Learning Frameworks:**
- TensorFlow
- PyTorch
- Scikit-learn

Methodology:

- This project proposes a methodology utilizing image processing and machine learning techniques to diagnose myopia and hypermetropia based on eye images.
- CNN is mostly used in the field of computer vision particularly in image classification problems.
- Extract relevant features from the images that are indicative of myopia or hypermetropia.

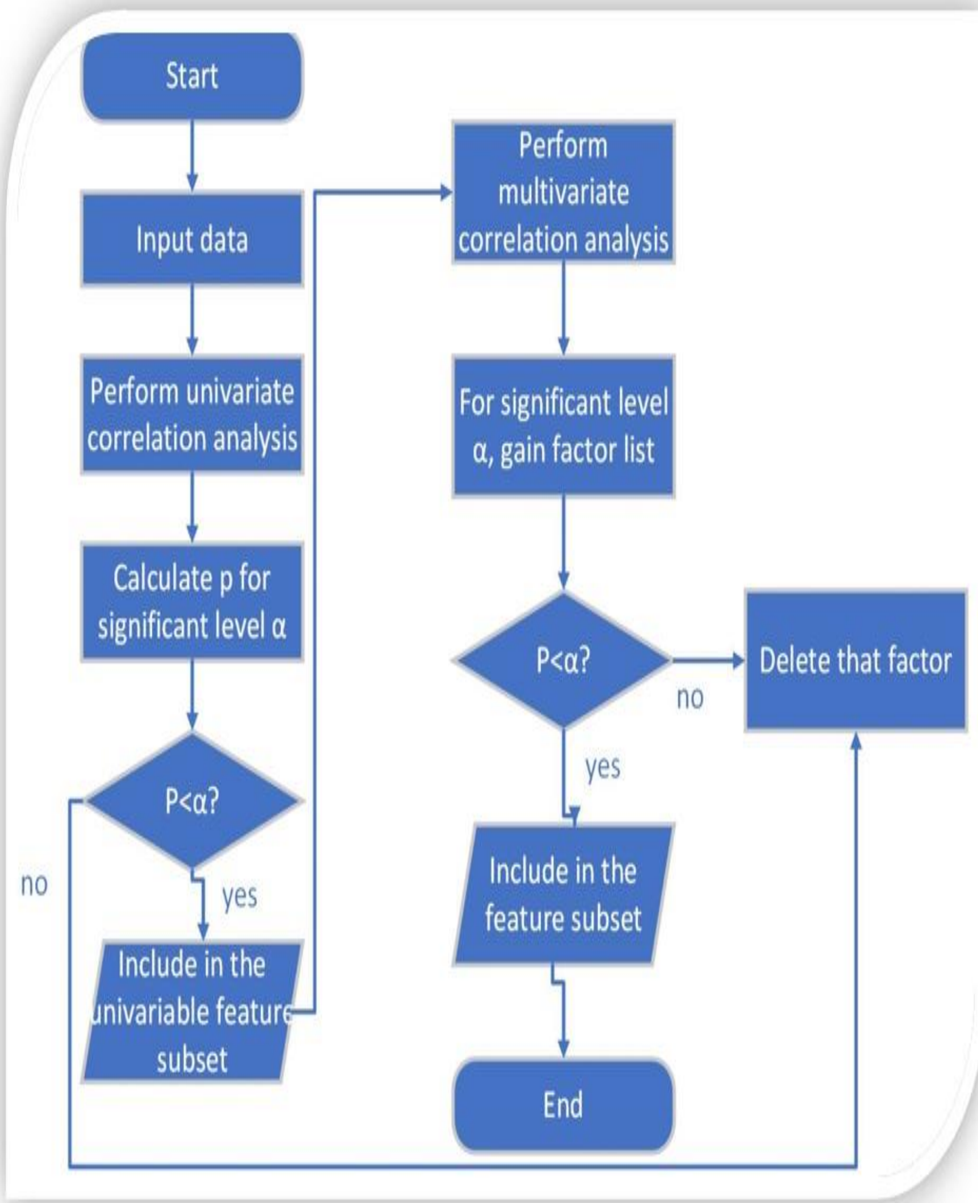
- Features could include corneal shape parameters, pupil-lens distance, blood vessel patterns, and other relevant characteristics.
- Deep learning algorithms like convolutional neural networks (CNNs) are well-suited for image analysis due to their ability to learn complex patterns from data.
- Train the model on the labeled dataset, allowing it to learn the relationship between extracted features and the presence/absence of myopia or hypermetropia.
- Fine-tune hyperparameters, experiment with different architectures, or incorporate additional features to enhance model performance.

OBJECTIVE:

- Develop an advanced system for the early detection and monitoring of myopia (nearsightedness) and hypermetropia (farsightedness) in individuals.
- Utilize advanced image processing techniques and machine learning to enhance the precision and reliability of diagnosis.
- Design the system to be user-friendly, ensuring accessibility for individuals from various backgrounds, including those with limited technical expertise.
- Explore the potential for telemedicine and remote

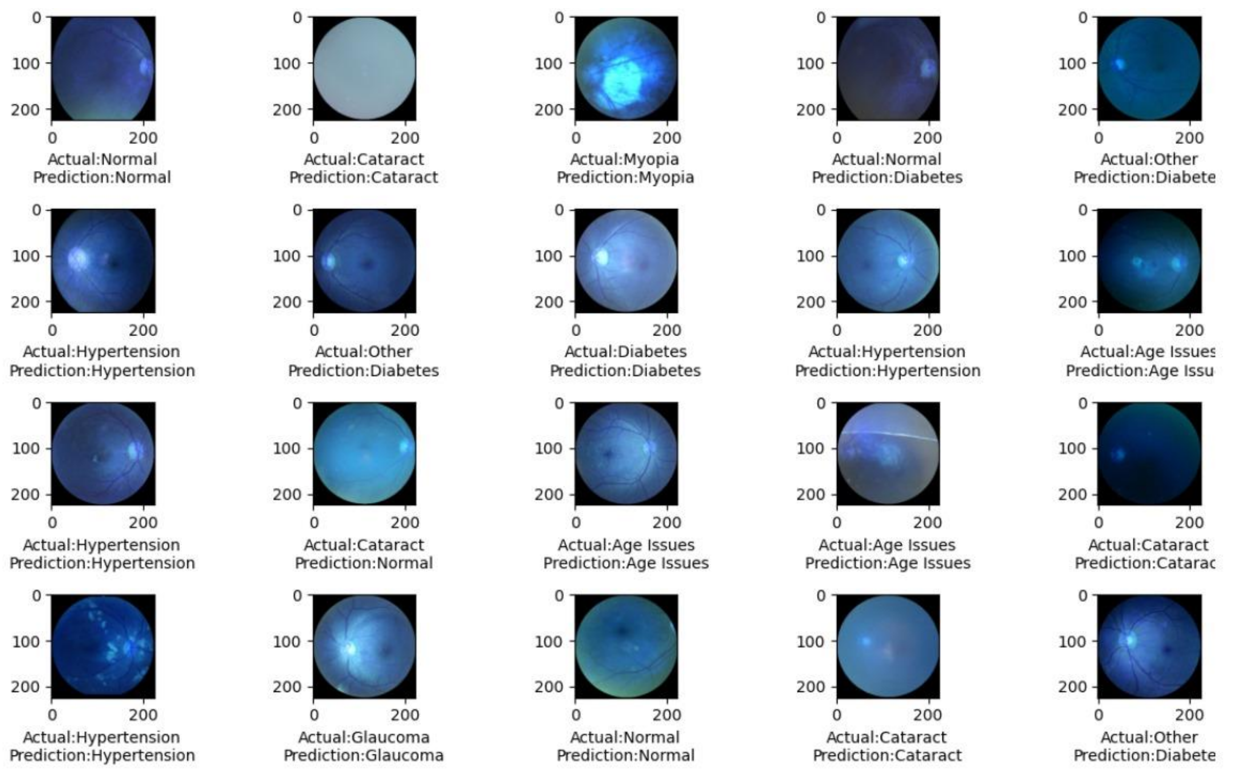
screening options to improve access torefractive error detection, particularly in underserved or remote communities.

Dataflow:



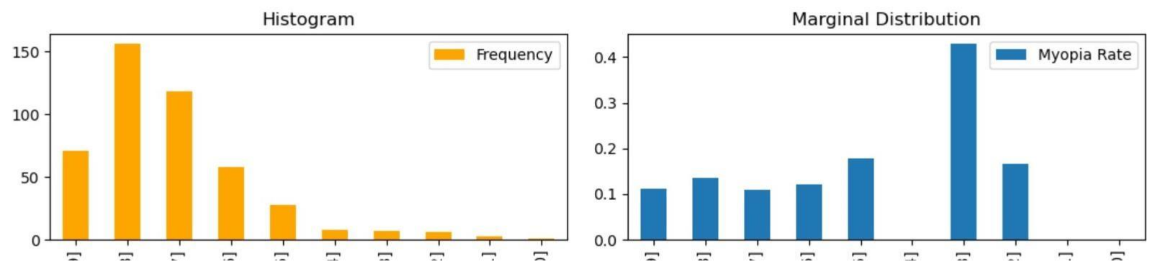
CHAPTER 4
RESULTS AND DISCUSSION

Here is our output :-



SAMPLE CODE:

- **df_hist = data.assign(bins = pd.cut(data[feat_nm],10,precision=1)).groupby('bins').agg(freq_cnt = ('ID','count'),mean_response = ('MYOPIC','mean')) df_hist['freq_cnt'].plot(kind = 'bar',rot = 90,ax = ax[0], color = 'orange', label = 'Frequency'); df_hist['mean_response'].plot(kind = 'bar', rot = 90, label = 'Myopia Rate', ax = ax[1]); ax[0].set_xlabel(feat_nm) ax[0].legend() ax[1].set_xlabel(feat_nm) ax[1].legend() ax[0].set_title('Histogram') ax[1].set_title('Marginal Distribution') plt.tight_layout() plt.savefig(f'eda_{feat_nm}.png', dpi = my_dpi);**



- gbdt_pi = dict(zip(features, list(r['importances_mean']))) gbdt_pi_sorted = sorted(gbdt_pi.items(), key = lambda x: x[1], reverse=True) importance = pd.DataFrame(gbdt_pi_sorted, columns = ['feature','gbdt_importance']) gbdt_rank
= [(v[0],i+1) for i,v in enumerate(gbdt_pi_sorted)]a

```
SPHEQ   0.335 +/- 0.030
SPORTHR 0.024 +/- 0.004
PARENTMY0.013 +/- 0.003
ACD     0.010 +/- 0.004
VCD     0.005 +/- 0.001
GENDER  0.001 +/- 0.000
DIOPTERHR0.000 +/- 0.000
LT      0.000 +/- 0.000
```

CONCLUSION:

- The Myopia and Hypermetropia Detection Project has made significant strides in developing an innovative solution for early detection and monitoring of common refractiveerrors.
- With a CNN algorithm, user-friendly interface, and successful integration with healthcare systems, the project is poised to make a substantial impact on eye health globally.
- The ongoing commitment to improvement and validation ensures the project's sustainability and relevance in the ever-evolving field of healthcare technology.

Future scope :

1. Integration of Multimodal Data:
   Explore the integration of additional modalities such as OCT images or genetic data to provide a more comprehensive assessment of refractive errors and enhance diagnostic accuracy.
2. Teleophthalmology and Remote Monitoring: Extend the system's capabilities for teleophthalmology applications, enabling remote screening, diagnosis, and monitoring of refractive errors, particularly in underserved or remote populations.
3. Integration with Wearable Devices:
   Investigate the integration of the system with wearable devices like smart glasses or contact lenses equipped with sensors for real-time monitoring and correction of refractive errors, offering more seamless and convenient solutions for users.
4. Population-Level Screening Programs:
   Collaborate with healthcare organizations and government agencies to implement population-level screening programs leveraging the system's capabilities for early detection and intervention of myopia and hypermetropia, contributing to public health initiatives and reducing the burden of vision-related disorders.

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