**Project Name**: Diagnosis of diabetes retinopathy

**Project Stakeholders**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Role** | **Position** | **Email** |
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**Project Description**

**Background**

Diabetic Retinopathy (DR) is a common complication among diabetic patients, and early detection is crucial to prevent vision loss. Currently, DR detection relies on manual analysis of retinal images, which is inefficient and prone to errors.

**Challenge or Opportunity**

Although professional ophthalmologists manually analyze fundus images accurately, the efficiency is low and the cost is high, especially in rural areas and areas with scarce medical resources and personnel. We hope to use AI technology to assist doctors in making more efficient judgments of lesion areas, handling more cases in a timely manner, and providing time for treatment

**Desired Impact（goal）**

1. AI systems can quickly process a large number of fundus images, improve diagnostic efficiency, shorten patient waiting time, and automatically generate reports.
2. AI can achieve remote diagnosis through mobile devices, greatly increasing the popularity of DR screening and reducing reliance on professional medical personnel.

**Measurable Organizational Value**

**(For reference only, it will be updated according to the actual situation)**

|  |  |  |
| --- | --- | --- |
| **Metric** | **Target Value** | **Measurement Method** |
| Detection Accuracy | ≥85% | Validation through test datasets |
| System Response Time | ≤3 seconds | Performance testing |
| User Satisfaction | ≥90% | User surveys |

**Project Scope**

**In Scope**

* Develop a deep learning-based DR detection algorithm.
* Design and implement user interfaces for doctors and patients.
* Provide lesion grading and treatment recommendations.

**Out of Scope**

* Does not include hardware development.
* Does not include large-scale clinical trials.

**Project Schedule**

* **Project Start Date**: March 24, 2025
* **Project End Date**: June 15, 2025

**Key Milestones**:

* Complete data cleaning and preprocessing for different datasets
* Reproduction of Deep Learning Model Code in Papers on Kaggle Website
* Testing system accuracy and exploring higher accuracy models
* Improve and optimize the code, write the front-end UI.

**Project Budget Summary (need discussing)**

**Quality Issues**

The system has a high recognition accuracy, can distinguish different types of lesions and annotate them clearly, can quickly process single images, has a friendly UI interface, has certain interactive functions, and supports the input of multiple images.

**Resources Required**

**People**

* Data Scientists: 1
* Software Developers: 1
* Clinical Consultant: 1
* Quality Assurance Manager: 1

**Technology, facilities and other**

* Deep learning frameworks (e.g. PyTorch, ResNet)
* Cloud computing resources (e.g., AutoDL)
* Retinal image dataset

**Assumptions and Risks**

1.Capable of obtaining sufficient quantity and quality of ophthalmic image data.

2.Develop effective deep learning algorithms for identifying DR lesion features.

3.The hardware and software resources required for system development can be guaranteed.

4.Data privacy and security issues need to be safeguarded.

5. The generalization ability of the model is insufficient, and the accuracy needs to be clinically tested.

6.The training and optimization of deep learning models require a large amount of computing resources and have certain economic costs.

**Project Administration**

* Weekly project team meetings.
* Monthly stakeholder updates.
* Regular code reviews and testing.
* Perform a project summary and evaluation after closure.

**Acceptance and Approval**

| **Name** | **Signature** |  |
| --- | --- | --- |

Beining Wang Chenyu Huang Zhengyu Zhou Peijin Chen

**References**

* Robert K. Wysocki. Effective Project Management: Traditional, Agile, Extreme, Hybrid, 8th ed., John Wiley & Sons, 2019.
* Roger Pressman, Bruce R. Maxim. Software Engineering A Practitioner's Approach, 9th ed., McGrawHill Education, 2020.
* William G. Sullivan et al. Engineering Economy. 17th ed,. Pearson Education, 2020.

**Terminology or Glossary**

* **DR**: Diabetic Retinopathy
* **MOV**: Measurable Organizational Value
* **ROI**: Return on Investment

**Appendices**

* Appendix A: RBS and WBS
* Appendix B: Project Team Gantt charts and total working hours

**Appendix A**

**A Brief Requirement Breakdown Structure**

**1. Overall project objective**

1.1 Develop an effective early detection system for diabetes retinopathy, realize automatic detection of diabetes retinopathy through artificial intelligence technology, reduce manual intervention, improve detection efficiency, and make the accuracy no less than 85%.

1.2 The system can classify based on the severity of the lesion, and automatically generate personalized treatment recommendations to help patients understand their own condition.

**2. Functional requirements**

**2.1 Data Input and Enhancement Processing**

Standardize the input image, further remove noise, perform pixel level annotation, brightness adjustment, etc.

**2.2 Hierarchical lesion detection algorithm based on deep learning**

Choose a suitable deep learning model (such as ResNet) and train the model to identify retinal lesions. It is possible to grade lesions and develop lesion grading algorithms. Model accuracy ≥ 85%, recall ≥ 80%.

**2.3 Automatic detection report generation**

Analyze the condition based on the test results, provide health guidance and suggestions, and provide a test report for doctors to review. The report includes the location, severity, and treatment recommendations of the lesion

**2.4 User Interface**

**2.4.1 Doctor interface**

Used to view patient test results, lesion grading, and treatment recommendations, supporting image upload, result viewing, report export, etc.

**2.4.2 Patient interface**

**3 Non functional requirements**

**3.1 Performance**

**3.1.1 System response time**

Ensure that the system can return results within a short period of time after users upload images.

**3.1.2 Support high concurrency user access**

The system can support concurrent access by at least 100 users simultaneously.

**3.2 Security**

Goal: All patient data must be encrypted during storage and transmission to ensure the security of patient information.

**3.3 Maintainability**

The system should adopt a modular design to facilitate future functional expansion and updates.

**A Brief Work Breakdown Structure**

**1. Develop a project plan**

Develop a detailed project plan, including a timeline, resource allocation, and risk management plan. Write a project plan document.

**2 Data Collection and Processing**

**2.1 Collecting retinal image data**

Download the open-source retinal image dataset from the internet and obtain the school's private dataset.

**2.2 Data cleaning and preprocessing**

Standardize the size of the collected images, remove noise and incomplete data, and perform class balance processing.

**2.3 Data augmentation**

Increase data diversity through data augmentation techniques such as rotation and flipping. Use the enhanced image dataset as input for system training.

**3 Algorithm Development**

**3.1 Development of lesion grading detection algorithm**

**3.1.1 Choose a deep learning model (such as ResNet)**

Search for suitable papers online (such as Kaggle) to study the deep learning models and attempt to reproduce and optimize them.

**3.1.2 Model Training and Validation**

Train the model using the dataset and perform cross validation. Analyze the results after grading and labeling, and consider which aspects can be further optimized.

**4 Integration of front-end interface development and report generation functions**

Attempt to develop prototype interfaces for doctors and patients, connect the front-end and back-end interfaces, design report templates that include lesion detection results, grading, and treatment recommendations, and integrate report generation functionality into the system.

**5 System Testing and Validation**

**5.1 Unit Testing**

Perform unit testing on each functional module to ensure proper functionality.

**5.2 System Integration Testing**

Test the integration between various modules to ensure the overall normal operation of the system.

**5.3 User Acceptance Testing**

Invite different users to conduct user acceptance testing to ensure that the system meets the requirements.

**6 Overall project management**

Regularly track project progress to ensure timely completion. Ensure effective communication between the project team and stakeholders once a week.

**Appendix B**

The total work hours:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Task** | **Start Date** | **End Date** | **Duration (Days)** | **Workload (Hours)** |
| 1. Develop a project plan | 3月24日 | 3月28日 | 5 | 5 |
| 2.1 Collecting retinal image data | 3月29日 | 4月2日 | 5 | 5 |
| 2.2 Data cleaning and preprocessing | 4月3日 | 4月9日 | 7 | 15 |
| 2.3 Data augmentation | 4月10日 | 4月15日 | 6 | 20 |
| 3.1.1 Choose a deep learning model | 4月3日 | 4月15日 | 13 | 15 |
| 3.1.2 Model Training and Validation | 4月16日 | 5月16日 | 31 | 30 |
| 4. Front-end & Report Integration | 5月2日 | 5月16日 | 15 | 20 |
| 5.1 Unit Testing | 5月17日 | 5月26日 | 10 | 20 |
| 5.2 System Integration Testing | 5月27日 | 6月5日 | 10 | 20 |
| 5.3 User Acceptance Testing | 6月6日 | 6月10日 | 5 | 20 |
| 6. Overall project management | 3月24日 | 6月15日 | 84 | 10 |
| Total estimate | \ | \ | 84 | 180 |

