**PROJECT PROPOSAL**

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| **Date of proposal:**  **10 Sept 2022** |
| **Project Title:**  An intelligent system for detection of ophthalmologic features from fundus photography |
| **Group ID (As Enrolled in LumiNUS Class Groups):**  **Team 6**  **Group Members (name , Student ID):**  **Li Zhenghao, Kelvin (A0031400J)**  **Lim Chang Siang (A0176266W)**  **Zheng Xiaolan (A0249271B)**  **Zhong Xiaohui (A0249305E)** |
| **Sponsor/Client:** *(Company Name, Address and Contact Name, Email, if any)*  Institute of Systems Science (MTech IS-PT04 Student),  25 Heng Mui Keng Terrace (119615),  Li Zhenghao, Kelvin,  E0396343@u.nus.edu |
| **Background/Aims/Objectives:**  **Background:**  Tele-Ophthalmology has a role in Medicine today. Progress in image capturing, lower cost of IT infrastructure, and patient’s acceptance for virtual services have enabled Ophthalmology to reach a wider patient base. Colour fundus photography is a simple and non-invasive test that patients can perform either in clinic or with novel techniques like smartphone photography. While the photography is currently graded by Ophthalmologists and/or clinical graders, there is a trend towards the use of artificial intelligence, specifically, deep learning, to assist in the diagnosis and triaging of eye patients. A foundational step in diagnosis is the identification of features both physiological and pathological. Most of the published retinal deep learning algorithm generates class labels using the final eye diagnosis but does not have enough granularity in identifying clinical features on the fundus. This has implications on the explanability of the model, and the ability for the model to adapt to new clinical grading systems.  **Aims:**  The project aims to train an artificial learning model to identify key defining clinical features from an ophthalmic colour fundus photo, from which, to summate based on existing clinical grading systems to reach a clinical diagnosis.  **Objectives:**  The objective of this project is to develop an intelligent system that can detect and identify the different features from an ophthalmic colour fundus photograph. |
| **Project Descriptions:**  The objective of this project is to develop an intelligent system that can detect and identify the different features of an ophthalmologic fundus photography.  The system should consist a web application interface that allow users to upload an image captured using camera, annotate the image with feature classification and display it on the screen to the user. The system should also produce a set of metadata that can be used to interact with other intelligent system for diagnosis inference.  A set of colour fundus images were obtained from the Rottendam Ophthalmic Data Repository, longitudinal diabetic retinopathy screening (<http://www.rodrep.com/longitudinal-diabetic-retinopathy-screening---description.html>). These consist of patients with diabetes who were screened for diabetic retinopathy during one week in June 2013. As the final grading form was not available on the repository, the images were individually graded by a single Ophthalmologist (KLZ). Subsequently, these images were labelled for physiological features (optic disc, optic cup, fovea), and pathological features (drusen, dot hemorrhages, microaneurysms, etc). They were then used to for training and validation.  To realize the intelligent pattern recognition, we will explore a broad range of artificial intelligences and machine learning techniques, including supervised learning such as Support Vector Machine (SVM), Decision Tree (DT), unsupervised learning techniques such as clustering, k-Nearest Neighbor (kNN), neural network (NN) and model optimization techniques. We will then evaluate the performance and suitability of the model developed using each of these techniques and report our findings in the project report. |