

# LECTURE 10:

## Research Proposal Preparation

FACULTY OF COMPUTING & INFORMATICS  
MULTIMEDIA UNIVERSITY  
CYBERJAYA, MALAYSIA

- Main elements of a research proposal.
- Common mistakes when writing research proposals.
- Examples of research proposals:
  - Masters degree by research;
  - Grant application (to a sponsor) for a two-year project

# What are the major elements of a research proposal?

A research proposal normally consists of the following sections:

- Introduction
- Justification of Research
- Research Objectives
- Literature Review
- Research Methodology
- References

- The purpose of the introduction section is to provide readers with the necessary background to understand the content of the proposal, especially the problem statement and the research methodology.
- A good introduction should:
  - Create interest in the topic
  - Give a broad foundation for the problem that motivated the study
  - Position the proposed research within the larger context of the research area.

# Justification of Research

- This section should contain the justification and importance of the work.
- Why this research should be carried out?
- The possible benefits/outcomes of this research

- The objectives are highly focused and precise statements of the objectives of a research project.
- Should not be too vague.
- Should be a list of items related to the research topic.
- Imply goals that your proposed methodology can achieve.

The literature review section of a research proposal is used to:

- Highlight the results of other researchers that are closely related to the proposed research.
- Provide a framework for establishing the importance of the proposed research.
- Provide a basis for benchmarking results obtained from the proposed research.

A well-written literature review should demonstrate that you have a grasp of the research area, and are aware of important recent developments in the area.

- The research activities should be described with as much details as possible.
- Explain (with as much details as possible) the steps that you will take to achieve the research objectives.
- You should clearly explain the following:
  - Detailed steps that you will take to design, implement and evaluate your solution.
  - The procedures that you will use to collect and analyze the data.



- Only references cited in the text should be included as references.
- Work which you may have referred to, but not cited in the text, should be placed in the *bibliography*.

# Common mistakes when writing research proposals

*Not following the required guidelines:*

- Page formatting (margins, font size, etc).
- Page limit exceeded.
- Unallowable expenses in budget (for grant application).

*The scope of work is too large*

- There is insufficient evidence that what is being proposed can be delivered.

*The proposal does not clearly show that the methodology is appropriate*

- For grant proposal, the researcher also has to justify the proposed equipment is appropriate.

*The proposal does not completely indicate related experiences of the project team members (for grant proposal).*

The rapid increase in the occurrence of diabetes is one of the greatest challenges to the current health care. The World Health Organization (WHO) reported that there are over 170 million people with diabetes worldwide. A number of them suffered from eye diseases such as diabetic retinopathy (DR) and glaucoma. These are common complications of diabetes and the leading causes of blindness . These are silent diseases and may only be recognized by the patients when changes in the retina have progressed to a level, where the treatment becomes complicated and nearly impossible.

It is believed that the screening of diabetics patients for the development of DR potentially reduces the risk of blindness by 50% . Manual analysis and diagnosis requires a great deal of time and energy to review photographs which are obtained by fundus camera. Therefore, automated analysis and diagnosis translates to a huge amount of savings in terms of the number of retinal images that need to be manually reviewed by the medical professionals each year .

The extraction of blood vessels in the retinal images can help physicians for the purposes of diagnosing ocular diseases, patient screening, and clinical study. Blood vessel appearance can provide information on pathological changes caused by some diseases including diabetes, hypertension, and arteriosclerosis.

To understand the changes in the branching pattern of retinal blood vessels remains a challenge in assessment of PR. As there is no prior way of identifying appropriate shape features for studying pathological changes in retinal blood vessels, the task remains to search for new sharp features that add new explanatory power and diagnostic accuracy.

The objectives of this research are as follows:

- ① To build a high quality multi-ethnic fundus image database for testing, training, and evaluation of algorithms for detecting diabetic retinopathy diseases.
- ② To develop efficient segmentation methods for the detection of blood vessels, optic disc, exudates, cotton wool spots, and other components.
- ③ To design and implement an automated screening system that provides reliable and robust result for screening diabetic retinopathy.
- ④ To evaluate the performance of the screening system in a clinical environment.

Vessel morphology has been quantified with geometrical and topological parameters such as length, angles, branching order, tree asymmetry, bending energy, fractal dimension, Sholl diagrams and area of influence [1]-[11]. However, accurate vessel detection is a difficult task due to reasons such as presence of noise, low contrast between vessels and background, variability of vessel width, brightness, and shape. Moreover, due to the presence of lesions, exudates, and other pathological effects, the image may have large abnormal regions.

To segment the blood vessels from the background, the necessary shape analysis to retinal blood vessels is considered as an initial step [12]. Various methods have been reported for the detection of vessels and edges such as matched filters, mathematical morphology, threshold probing, centerline approach, ridge-based approach, supervised classification, deformable models, and tracking [13]-[20]. The vessel detection method can be motivated by the homogeneity based regional recursive decomposition property of the quadtree data structure in [21]-[24].

The methodology section can be divided into two parts:

- Ⓐ Preprocessing and segmentation techniques to detect blood vessel, optic disc, exudates, and cotton wool spots.
- Ⓑ Classification approach with neural network.



## A. Preprocessing and Segmentation Techniques

- The green channel image is considered in several works [17][18][19][26] as the natural basis for vessel segmentation because it normally presents a high contrast between vessels and retinal background. Initially, the original retinal color image can be taken as the input and the green color component is extracted. The image is cropped before any processing is performed. This helps in decreasing the computational time, focusing on the region of interest, viz the retina, and making the image dimension a positive integer power of 2. If necessary the algorithm pads the input image with zeros. Each image is cropped at rows 40 and 551 and at columns 30 and 541. Cropping has decreased the size of the image from 584 by 565 to 512 by 512.

## B. Classification Approach using Neural Network

- Neural networks can be used to simulate biological learning and widely used in pattern recognition [39]. The network is a collection of elementary processor (nodes). Each node takes a number of inputs, performs elementary computations, and generates a single output. Each node is assigned a weight and the output is a function of weighted sum of the inputs. These weights are learned through training and then used in the recognition. Back-propagation algorithm is a widely used learning algorithm. One of the advantages that make neural networks attractive in medical image segmentation is their ability to use nonlinear classification boundaries obtained during the training of the network. Another attractive feature of the neural nets is the ability to learn. With the selection of a good training set which includes all possible features or retinal objects, the network can learn the classification boundaries in its feature space. One of the disadvantages of NN is that they need to train every time a new feature is introduced the network. Another limitation is that it is difficult to debug the performance of the network.

# Declaration & Acknowledgment

The contents presented in this slide are meant for teaching purpose only. No commercialized component exist. The texts are partially copied from the textbooks and images are downloaded from the internet.