Cardiff School of Computer Science & Informatics

Large One Term Individual Project

CM3203

Initial Plan

40 Credits

Medical image processing Lesions

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Project Description

According to Cancer Research UK melanoma is the 5th most common cancer in the UK, accounting for 4% of all new cases. Becoming the most rapidly increasing in incident rates than any other of the ten most common cancers in the UK.

Using C# as my programming language of choice I will emulate and possibly build on the work conducted by H. Ganster, A. Pinz, R. Röhrer, E. Wildling, M. Binder, and H. Kittlerto (in their paper Automated Melanoma Detection) and use image processing to identify benign, dysplastic and malignant lesions.

The images I have been provided to work with are the images used in the paper stated above, these images are Epiluminescence microscopy (ELM) images. ELM is a non-invasive technique that projects halogen light onto the skin surface rendering the surface translucent and makes sub-surface structures visible. This has become an important tool in the early recognition and diagnosis of malignant melanoma.

The first step in my recognition system will be segmenting the lesion in the ELM image, this will require me to research and experiment with several different forms of feature extraction techniques ranging from low level techniques such as Edge-Detection to shape based techniques like the Hough transform. The aim is to find the technique (or combination of techniques) that will best extract the lesion from the ELM image. Once the feature is extracted, I will research the best suitable way to describe the extracted lesion by shape, colour and texture.

I will then train an appropriate classifier (such as Decision Tree or Support Vector Machine) using various amounts of the described extracted lesions mentioned above as training data. I will use various amounts of training data to experiment with how accuracy increases with the increasing amounts of training data.

Project Aims and Objectives

Aim: Produce Graphical User Interface to display the input and output results

Objectives:

- Use C# Winforms to produce a simple GUI

- Use Model View Presenter (MVP) design pattern

- GUI may have a basic layout

Aim: Build lesion recognition pipeline

Objective:

- Select and incorporate appropriate classifier

- Firstly Test pipeline with simple image data (e.g. RGB mean)

Aim: Accurately extract lesion from ELM image

Objective:

- Research image segmentation functions

- Program various segmentation techniques

- Experiment with various pre-processing edits (e.g. blurring the image)

Aim: Describe features of the extracted lesion

Objective:

- Research algorithms to extract features from lesion image

- Try different feature types with the classifier

- Experiment with various combinations

Examples include:

- Describe shape of lesion (e.g. circularity to detect how round the lesion is)

- Colour analysis of the lesion (e.g. the redness of an image

Aim: Train and Test the classifier

Objectives:

- **Method 1 (splitting data)**
  - ➢ Split lesion images into two sections, testing and training
  - ➢ Training data trains the classifier
  - ➢ Testing data is passed through classifier
  - ➢ Result shows how well the classifier identifies lesions
  - ➢ Experiment with various amounts of testing and training data

- **Method 2 (K-Fold cross validation)**
  - ➢ Use all but one image as training data
  - ➢ Test the classifier with the remaining image
  - ➢ Result shows how well the classifier identifies lesions
  - ➢ Repeat with different test image and rest of images as training data
  - ➢ Repeat until all images has been used as test data

Work Plan

Supervisor Meetings

My supervisor and I have scheduled a weekly meeting every Monday at 13:00 in order to discuss the progress of the project.

Deliverables

- Weekly reports documenting the progress of the project
- Final Report
  - ➢ Documentation describing approach taken to project
  - ➢ Documentation cumulating the weekly reports to describe its progress
  - ➢ List of successful and unsuccessful aims, providing reasons for any failure
  - ➢ Discussion of how to improve the project in future
  - ➢ Conclusion discussing what I have learned with this project
- Software performing image processing to recognise malignant lesions

Week by week plan

Week 1

• **Complete initial plan**
• **Initial investigation**
    ➢ **Investigate classifiers and their use**
    ➢ **Investigate feature extraction techniques**

Week 2
• **Draw paper prototype of Graphical User Interface** • **Set up simple program pipeline with selected classifier** • **Test pipeline with simple image data** • **Research image segmentation techniques**
Week 3
• **Finish researching feature extraction techniques** • **Program image segmentation techniques found in research**
Week 4

• **Experiment with segmentation functions**
    ➢ **Experiment with combining techniques**
    ➢ **Experiment with pre-processing editing (e.g. blurring)**
• **Research Feature Extraction Techniques**

Week 5
• **Finish Researching Feature Extraction Techniques** • **Program feature extraction techniques to describe lesions (e.g. shape, colour, texture)**

Week 6

• **Finish Programming Feature Description**
• **Train classifier with extracted regions and their descriptions**
    ➢ **Experiment by varying the amount of training data to test accuracy**
    ➢ **Experiment using K-Fold cross validation**
• **Test classifier with test data**

Week 7
• **Continue and finish training classifier** • **Continue testing classifier with test data**
Week 8

• **Create Simple GUI**
    ➢ **Link GUI with classifier**
    ➢ **Display results on GUI**

Week 9
• **Write Final Report**
Week 10
• **Continue Writing Final Report**
Week 11
• **Complete Report** • **Hand in completed Report**

Gantt Chart

Weeks

Tasks	1	2	3	4	5	6	7	8	9	10	11
Write Initial Plan	■										
Initial Investigation	■										
Design GUI Prototype		■									
Set up Simple Pipeline		■									
Research Image Segmentation		■	■								
Program Image Segmentation			■	■							
Research Feature Extraction				■	■						
Program Feature Extraction to Describe Lesions					■	■					
Train Classifier						■	■				
Test classifier with test data						■	■				
Create simple GUI								■			
Write Final Report									■	■	■
Submit Final Report											■