Outline Project Specification

Entropy-based metrics for joint-alignment of images

Laura Collins

University of Aberystwyth

January 2016

Contents

Chapter 1

Project Description

There are two different ways of approaching Medical Diagnosis using Computer Vision techniques. The first, Abnormality detection is prone to misdiagnosis as commonly no abnormalities are present, even in cancer-positive scenarios. The second approach is cancer risk assessment by categorising breast tissue into 1 of 4 'types' as specified by BI-RADS (Breast Imaging-Reporting and Data System) - with 'a' being extremely fatty tissue (lowest risk) and 'd' being dense tissue (highest risk).

The project will encompass a sleek GUI for users to input a set of mammography scans, select their alignment metric (from a list of Information Entropy, Fuzzy Entropy) and then the software will output the average image of the input set.

The idea would be the software creates an average image per tissue composition category. This can then either be used to classify new instances of mammography scans or can be used to create a roadmap to aid Doctors in offline diagnosis.

Chapter 2

Proposed Tasks

2.1 Research into previous work

Work has been done using the Congealing method on 3D MRI scans on brightness alignment.

2.2 Integrating existing Congealing algorithm

The Congealing algorithm has been implemented in both C++ and Objective-C. As my programming language of choice is Java, I will need to take one of the implementations and wrap it to be able to integrate it with the rest of my code.

I had an early decision to make as to whether I would program the entire project in C++ to accommodate the Congealing code, whether I would write my own implementation of Congealing in Java (this would ultimately be a great extra project, but I worry it would take away from my final goal) or finally whether I would wrap the existing open-source code by MIT and integrate it.

2.3 Graphical User Interface

Chapter 3

Project Deliverables

Bibliography

[1] R. Mifflin. Semismooth and semiconvex functions in constrained optimization. *Siam Journal on Control*, 15:957–972, 1977.

This is the first appearance in the literature of the concept of a semismooth function. Semismooth functions are closed under addition and composition, and also guarantee the local convergence of nonsmooth generalizations of Newton's method.

Appendix A

Some appendix