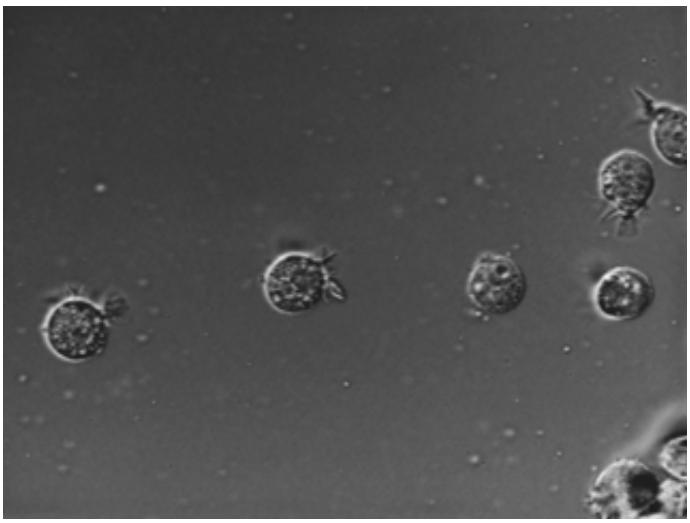
Region of Interest Assignment
Game Console Development
COMP10037

Issue Date: Thursday, October 13th, 2016
Due Date: **5pm, Friday, November 18th, 2016**

Overview

There is a requirement to develop an automatic *Region of Interest (ROI)* detector as part of a cancer cell analysis computer vision application. A ROI is a region detected within an image scene that bounds a target object of interest within an image. The same concept appears commonly in face-detection and gesture recognition software. Your application should be an *optimised solution* that runs on PS3 Cell Broadband Engine hardware to exploit as much of the available processing power as possible. The assignment requires investigation using online resources including the research papers provided.



The ROI detector that it to be developed should be capable of detecting ROIs from a video sequence of rat prostate cancer cells. The premise is that

a bounding box selects a likely cell from the background image from frame to frame.

We will use an idea inspired by Phung and Bouzerdoum [1] where a box with a certain edge density will be considered to be the likely target ROI. The *edge density map* for the image is searched until an appropriate candidate is found. This requires that we average the edge densities for many rectangular boxes in the search space. You will be expected to find a fast way of doing this using *integral images* [1,2].

Initially edge densities are to be found using simple kernel processing. The *Sobel transform* [3] would be a simple way to generate a *gradient map* to find edges from each original image that forms the video sequence.

Coursework Goals

a. Your solution should *demonstrate the use of optimising SIMD intrinsics, Multicore decomposition, SPU intercommunication as well as algorithmic optimisation* where possible.

b. You application components should be *developed and tested in phases* i.e. Get a C++ version of important ideas working before parallelisation or any other optimisation.

c. Each component should be *properly tested; with the testing approach and the outcome of testing recorded.*

d. Decisions about *efficient use of SPU local memory management* will have to be made consistent with the capabilities of DMA access.

e. You are required to provide an appropriate visual representation of the final output from your application.

f. Extra marks will be awarded for particularly *interesting algorithmic and decomposition* approaches provided that they are shown to be practical and viable.

Resources

a. You have access to a sequence of 10 frames of test video showing the rat cells[1]. These are in .TIFF and raw grey scale (unsigned byte) 640x480 form so that file format handling is not an issue in this exercise.

b. The video sequence is available for perusal as an .mp4 file.

[1]Image files are courtesy of Alan Partin, Johns Hopkins University

References

[1] "Detecting People in Images: An Edge Density Approach", Son Lam Phung, A. Bouzerdoum, University of Wollongong

[2] "Summed-area tables for texture mapping", F. Crow, SIGGRAPH '84: Proceedings of the 11th annual conference on Computer graphics and interactive techniques. pp. 207212, 1984.

[3] "Performance Evaluation of Edge Detection Techniques for Images in Spatial Domain", Mamta Juneja , Parvinder Singh Sandhu, International Journal of Computer Theory and Engineering, Vol. 1, No. 5, December, 2009

Submission

You should work in groups of two or three. Submit the code you develop, along with a pdf report of approximately 3000 words; as a single zip to Moodle by the date noted above. The written report should make good use of figures; such as diagrams, graphs, tables, schematics, screen shots, as necessary. These aspects of the report should be inline in the text and not in an appendix.

Marking Scheme

The assignment is worth 60% of the marks awarded for the entire COMP10037 module. The following provides a breakdown of the marking scheme:

Introduction	5%
Background	20%
Algorithms and Code	20%
Parallelisation and Performance	20%
Testing	10%
Results	10%
Analysis/Conclusions	5%
Description of work performed by *each student*	10%