'396' Undergraduate Research Project Application Form

Office for Undergraduate Research in Science
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Form version 200603

Instructions for students

- *All fields are required, unless indicated otherwise.*
- Download and print this form. Complete Section 3 and sign.
- See "How students can apply" instructions in Section 2.9.
- Your supervisor or department will tell you if you are selected for this project. If so, you will receive a code to register for a '396' course on MINERVA.

1 Supervisor Information

Name:	Prof. Thomas P. Wihler
Email:	wihler@math.mcgill.ca
Phone:	514-398-3832
Website:	www.math.mcgill.ca/∼wihler
Department or Unit:	Department of Mathematics and Statistics
Course number:	MATH 396

2 Project Information

2.1 Term:

Summer 2006

2.2 Project start & end dates:

May 1 - August 31, 2006

2.3 Project title:

Numerical Methods for Variational Image Denoising

2.4 Project description:

An important aspect in image processing is the use of suitable denoising techniques. Here, an interesting approach is the use of nonlinear elliptic PDE filters, which are based on appropriate variational approaches.
The aim of this project is the development of new computational methods for the discretization of nonlinear filters in image denoising, and their comparison to standard methods.
The project will consist of three parts: 1) As a starting point, the student will implement (using MATLAB) standard finite difference (FD) schemes for the discretization of nonlinear PDE filters. 2) In a subsequent step, he or she will modify existing MATLAB code to implement finite element methods for the same class of PDEs; these methods shall be designed in such a way that the computational cost is equivalent to the FD methods in 1); numerical experiments will allow a comparison of the two different approaches in 1) and 2). 3) In addition, a third class of numerical methods, so-called discontinuous Galerkin (DG) discretizations, shall be explored (again, by modifying existing code); DG schemes provide some interesting properties such as, e.g., the handling of nonsmooth solutions, which could play an advantageous role in the discretization of the proposed problems.

2.5 Prerequisites:

1 term completed at McGill + CGPA $\geq$ 3.0; or permission of instructor.

2.6 Grading scheme:

50% overall performance during the term (based on originality, independence, and intermediate progress)+ 50% final report.

2.7 Status:

This project is:
( ) Open to applicants
(X) Already taken; no more positions available this term
( ) Taken, but contact me for other possible projects this term

2.8 Ethics, safety, & training:

Which of the following, if any, is involved?
( ) Animal subjects
( ) Human subjects
( ) Biohazardous substances
( ) Radioactive materials
( ) Handling chemicals
( ) Using lasers
For undergraduate students, ethics and safety compliance is the supervisor's responsibility.

2.9 How students can apply:

3 Student Information. (1) Print legibly and sign. (2) See 'How students can apply' in Section 2.9.

Name:	
McGill ID:	
Email (first.last@mail.mcgill.ca):	
Phone:	
Program (e.g., B.Sc. Maj. Chem. Minor Biology):	
Level: (circle one)	U0 / U1 / U2 / U3
I have not applied for another 396 course this term. **Student signature:**	
Date:	

4 Approvals. (1) Print names and sign. (2) Notify Office for Undergraduate Research in Science. (3) Give student code to register for course on MINERVA.

Supervisor:	
Date:	
I certify that this project conforms to departmental requirements for 396 courses. **Unit Chair, Director, or designate**	
Date:	