BMI/CS 567: Medical Image Analysis Spring 2020

Syllabus

Instructor: Daniel L. Pimentel-Alarcón

GO GREEN. AVOID PRINTING, OR PRINT 2-SIDED MULTIPAGE ;)

Course Description

This course gives a hands-on introduction to medical image analysis techniques. We will be using Matlab, but you are welcome to use something cooler, like Julia. Topics include medical imaging formats, segmentation, registration, image quantification, and classification. Students should have prior exposure to basic statistics, and should feel comfortable coding.

Instructor

Daniel L. Pimentel-Alarcón
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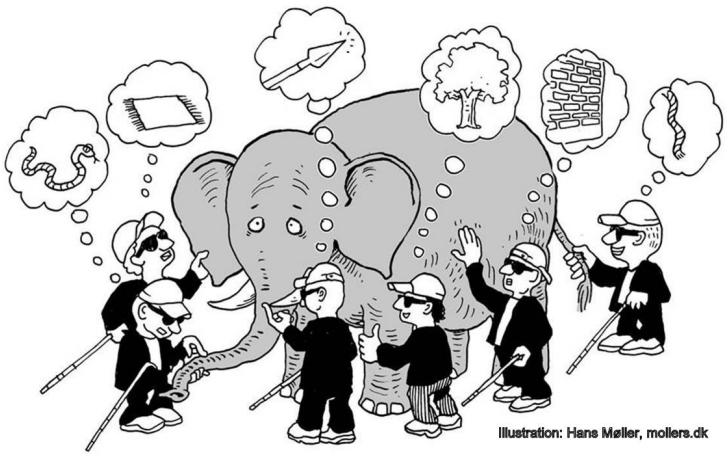
`http://danielpimentel.github.io`

Lectures

Tuesday, Thursday
2:30-3:45pm
2321 Engineering Hall.

Office Hours

Tuesday, 4:00pm-5:00pm,
By appointment.



As we move along the course, we will dive into some math. We will see some equations, some theorems, some algorithms, etc. Knowing your math is important. It is important to understand the steps of an equation or the proof of a lemma. Each of these is an important **piece of the problem**. However, be careful not to loose track of what is the problem! It is equally important (or perhaps even more so) to **understand the big picture** and how the pieces come together.

Prerequisites

Basic background in:

- Linear Algebra
- Probability/Statistics
- Programming

Topics

- Basic Image Manipulation
- Histograms
- Segmentation
- Hough Transform
- Filtering
- Fourier Transform
- Image Registration
- Image Morphology
- Cross Validation
- K-Nearest Neighbors
- Linear Discriminant Analysis
- Logistic Regression
- Random Forests

Grading

- 50% Homework
- 50% Project

Grading scheme:

- A (above 95%)
- AB (above 90%)
- B (above 80%)
- BC (above 75%)
- C (above 65%)
- D (above 60%)
- F (below 60%)

Textbook

This course will mainly follow the content in:

Applied Medical Image Processing: A Basic Course, by Wolfgang Birkfellner, Second Edition

Homework

There will be 4-5 homework assignments, which will be posted at:

`https://danielpimentel.github.io/teaching.html`

Students are strongly encouraged to work together on homework assignments, but each student must submit their own individual writeup. Plagiarism of material written by classmates, book or article authors, or web posters is prohibited. Academic integrity will be strictly enforced.

Project

The project will challenge you to use the tools learnt on this course (and ideally others) to analyze a real dataset (that I will provide). Details will be posted at

`https://danielpimentel.github.io/teaching.html`

If you would like to use another dataset, let me know and we will discuss this option. The project is due on the last day of class. You may work in teams of no more than 3 people.

Additional resources

- Guide to Medical Image Analysis, Methods and Algorithms by Klaus Toennies. This book is free from the UW library website.
- You can download the student version of MATLAB for free from the Campus Software Library: `https://software.wisc.edu/cgi-bin/ssl/csl.cgi`

Academic Policies

- The course syllabus provides a general plan for the course; deviations may be necessary.
- **Evaluations.** Your constructive assessment of this course plays an indispensable role in shaping education at UW-Madison. Upon completing the course, please take the time to fill out the online course evaluation.
- **Academic Integrity.** By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review.
- **Accommodations for Students with Disabilities.** McBurney Disability Resource Center syllabus statement: The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), andUW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty will work either directly with the student or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.
- **Diversity and Inclusion.** Institutional Statement on Diversity: Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from everybackground – people who as students, faculty, and staff serve Wisconsin and the world.
- **Religious Observances.** UW faculty policy states that mandatory academic requirements should not be scheduled on days when religious observances may cause substantial numbers of students to be absent. Refer to the university's Academic Calendar for specific information.