

Computer Science Department

Andrea Lanter
4732-G Boelter Hall
Box 951596
Los Angeles, CA 90095-1596
(310) 825-4943

To: Professor Jeff Eldredge, FEC Chair

From: Richard Korf, Vice Chair for Undergraduate Programs, Computer Science Department

Adnan Darwiche, Chair of Computer Science Department



Date: November 22, 2017

Re: CS and CS&E Course Creation CS 168, Request for Approval

We propose the creation of the new course, Computer Science 168. We request that these changes take effect for Spring 2018.

Regarding Computer Science 168:

This project-based class will cover applied topics in medical imaging including image processing (2D transformation, interpolation), medical image atlas construction (co-registration, standardization), predictive modeling, personalized medicine, data driven and machine learning methods (including unsupervised, supervised, and semi-supervised methods).

Additionally, this course covers both the theory and practice of medical image acquisition including angiography, computed tomography (CT), and magnetic resonance (MR). The physics behind these imaging technologies will be provided at an introductory level. The course is directed primarily toward undergraduate and graduate students in computer science and engineering, as a first exposure to computational medical imaging. Enforced prerequisites include CS 32 or Program in Computing 10C with grade of C- or better, Mathematics 33A, and one course from Civil & Environmental Engineering 110, Electrical and Computer Engineering 131A, Mathematics 170A, or Statistics 100A. Moreover, the knowledge of at least one programming language is strongly recommended to be able to complete the bi-weekly coding projects. Integrated lectures and discussions present how the medical images are acquired; an elementary description of physics underlying the image acquisition (particle physics, electromagnetic spectrum, physics of X-rays production, and concept of magnetic resonance) is combined into a set of lectures that provide task-driven lessons for refining conceptual understanding of their functioning. The course then transitions to the computerized medical image representation. Computational processing of images is then covered with the purpose of providing a practical guide to the most common tasks used today in medical imaging (including improvement of image quality, pattern recognition, and predictive analytics). Finally, the introduction to applied machine learning is directed towards algorithms that are typically applied in the context of medical imaging to solve segmentation problems and prediction tasks for example.

Medical imaging has experienced several revolutions in the last two decades, including the popularization of MRI and the use of machine learning for processing. This course would

greatly improve the exposure of computer science and engineering students to modern medical imaging techniques. While image processing, computer vision, machine learning classes may have some overlap with the proposed course, it would be a unique and centralized view on the state-of-the-art in medical imaging. The techniques used in medical imaging have become highly specialized and are typically not covered in other classes.

Professor Scalzo has taught this course and refined it over the last two years based on class surveys. In Winter 2016, Professor Scalzo had 20 students enrolled; in Spring 2017, 64 students were enrolled. With the feedback from these classes, he has noticeably reduced the lessons about basic physics and emphasized the machine learning and image processing content. As faculty with dual affiliation in the department of Neurology and Computer Science, Professor Scalzo is perfectly positioned to offer this class as he is using the latest neuroimaging techniques daily and developing new machine learning algorithms to solve medical imaging problems (including cancer detection, and brain lesion segmentation).

Given the great interest in medical imaging and machine learning, we anticipate that the proposed course will have a large following once it's established. Finally, this course has been approved by the Computer Science departmental Academic Policy Committee for proposal.

We appreciate your kind consideration.