CS 685 Section 001 – Cognitive Computing

Fall 2017

Instructor: Simone Silvestri
Email: silvestri@cs.uky.edu
URL: http://www.cs.uky.edu/~silvestri/teaching/cognitiveComputing/
Office hours: TBA
Credits and Contact Hours: 3 credit, 3 contact hours
Class schedule: Tuesday - Thursday, 3:30PM-4:45PM
Classroom: Robotics & Manufacturing Bldg - Room 323

Catalog description

This graduate course overviews recent advancements in Cognitive Computing with particular emphasis on solutions based on the paradigm of the Internet of Things. Specific topics include activity detection algorithms based on wearable devices (e.g., walk, run, sleep), activity recognition in smart homes (logic-based approaches, probabilistic methods and data mining methods), inference algorithms for attention and stress level, and emotion recognition methods (e.g., anxiety and anger) using wearable devices and car driving patterns.

Course description

Cognitive Computing is an emerging research area which aims at developing "solutions and systems that learn at scale, reason with purpose and interact with humans naturally" [IBM]. It is an inherently multi-disciplinary research, which lies at the intersection between Computer Science, Artificial Intelligence, Psychology, and Social-Behavioral science.

This graduate course overviews recent advancements in Cognitive Computing with particular emphasis on solutions based on smart devices such as smart phones and smart watches. Specific topics include activity detection algorithms based on wearable devices (e.g., walk and sleep), emotional state inference (e.g., stress, attention, anxiety), mental and physical health problems (e.g., cognitive impairment and Parkinson’s disease).

The course will survey recent research papers on this topic. It will provide a rigorous description of the unique techniques and the methodologies adopted as a consequence of the human nature of the considered problems.

Evaluation

Students will be evaluated by means of two written take-home assignments, oral presentations of research papers and through an individual project on topics related to the course. The project may be of research or survey nature. Research projects should result in a research paper with publication potential, which proposes a novel solution to a problem related to the course. Survey project should instead result in a survey paper that coherently describes and compare existing solutions on a specific problem related to the course. Both project types should be discussed with the instructor in advance. The project should be presented to the class.
In summary, the evaluation will be based on:

- Two take home assignments
- Oral presentations of a scientific paper
- One research or survey paper to be completed by the end of the course
- Project presentation

**Prerequisite:**
Background in networking, algorithm design & analysis, and familiarity with probability and statistics, is preferred.

**Grading**
Assignments (30%), presentation (30%), projects (40%).
Criteria for grading A: 86-100%, B: 76-85%, C: 65-75%, D: 50-64%, F: 0-49%.

**Outcomes of Instruction**
Students will demonstrate understanding of cognitive based computing, with emphasis on wearable devices based solutions. Specifically, students will:

1. Understand how to design algorithmic solutions that involve humans
2. Know data analysis tools for data generated from wearable devices
3. Know how to tailor machine learning solutions for human cognitive inference
4. Learn how to design studies that involve human subjects

**Detailed topics**
The following is a summary of the topics covered in the course. As interesting papers will be published, some materials maybe added to the following list. Students will be notified sufficiently in advance of any change.

*Activity recognition with wearable devices*

- Physical activities (walking, standing, etc.)
- Sport related activities
- Sleep monitoring

*Inference of emotional state*

- Attention and engagement
- Sentiment analysis
- Stress level
- Anxiety and anger
**Inference of health conditions**

- Cognitive impairment
- Schizophrenia
- Parkinson’s disease

**Various topics**

- Methodology of collecting human related data
- Inferring user comfort
- Behavioral authentication
- Social-behavioral aware optimization

**Class policy**

- Syllabus, homework assignments, announcements, and other related materials can be accessed on the class website. Make sure that you regularly check the site for announcements and course related materials.
- Class notes will not be available and slides will not be used, students are encouraged to attend classes to better follow the course topics.
- Students are encouraged to discuss the assignments, however homeworks must be individual efforts. All assignments which would result too similar will be graded zero and standard university procedures will be taken.
- No late homework or project will be accepted.

**Attendance and excused absence**

Attendance in classes is required. Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit reasonable cause for nonattendance by the professor. Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754). Students are expected to withdraw from the class if more than 20 percent of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

**Academic Integrity**

Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or
the student has other academic offenses on their record, more serious penalties, up to suspension from the
university may be imposed. Plagiarism and cheating are serious breaches of academic conduct. Each student is
advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student
Rights and Responsibilities. Complete information can be found at the following website: http://www.uky.edu/Ombud. A plea of ignorance is not acceptable as a defense against the charge of
academic dishonesty. It is important that you review this information as all ideas borrowed from others need
to be properly credited. Part II of Student Rights and Responsibilities (available online
http://www.uky.edu/StudentAffairs/Code/part2.html) states that all academic work, written or otherwise,
submitted by students to their instructors or other academic supervisors, is expected to be the result of their
own thought, research, or self-expression. In cases where students feel unsure about the question of
plagiarism involving their own work, they are obliged to consult their instructors on the matter before
submission. When students submit work purporting to be their own, but which in any way borrows ideas,
organization, wording or anything else from another source without appropriate acknowledgement of the fact,
the students are guilty of plagiarism. Plagiarism includes reproducing someone else’s work, whether it be a
published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism
also includes the practice of employing or allowing another person to alter or revise the work which a student
submits as his/her own, whoever that other person may be. Students may discuss assignments among
themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student,
and the student alone. When a student’s assignment involves research in outside sources of information, the
student must carefully acknowledge exactly what, where and how he/she employed them. If the words of
someone else are used, the student must put quotation marks around the passage in question and add an
appropriate indication of its origin. Making simple changes while leaving the organization, content and
phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so
generally and freely circulated as to be a part of the public domain (Section 6.3.1). Please note: Any assignment
you turn in may be submitted to an electronic database to check for plagiarism.

Accommodations due to disability

If you have a documented disability that requires academic accommodations, please see me as soon as
possible during scheduled office hours. In order to receive accommodations in this course, you must provide
me with a Letter of Accommodation from the Disability Resource Center. The Disability Resource Center is
located in the 4th Floor of the Multidisciplinary Science Building on the corner of Rose Street and Huguelet
Drive. Address is: 725 Rose Street, Multidisciplinary Science Building, Suite 407 Lexington, KY 40536-0082