INLS 490:
Real-time Data Science in the Makerspace: Making Sense of the Everyday

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Room: Virtual (Tuesdays) and Manning 30* (Thursdays, 11:00-12:15pm)

*We will meet in Manning 14 for the First Day of Class, 8/19/21

Sakai: https://unc.live/3CTehWY**| Zoom**: https://unc.zoom.us/j/95527626506

Office hours by appointment.

COURSE OVERVIEW

Data science is changing the way we do science, business and even everyday life. Data science spans multiple disciplines, and applies scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data. In this course, we are particularly interested in collecting and applying real-time data to gain insights and knowledge about environmental and ecological phenomenon around us. Real-time data from multiple sensors can be fused and analyzed to get a deeper understanding of micro-climates including those in and around buildings and communities. In this course, students will posit research questions about enviro-sensing, build sensor systems for gathering multiple-types of real-time data in order to test their hypothesis. Students will develop or refine existing skills working with fabrication technologies often found in makerspaces such as 3D printing, laser cutting, and sewing. Students will also gain experience in managing data life-cycles by developing data pipelines to gather, store, and analyze data to effectively extract and visualize useful information.

PREREQUISITES FOR THIS COURSE

1. Critical thinking – the ability to challenge what you think may be common sense; to ask questions and seek empirical evidence

2. Reflexivity – the ability to look at your own experiences, beliefs, and behaviors

3. Compassion – for others and for yourself

4. Willingness to experience and sit with discomfort

5. Curiosity – to try something new

COURSE OBJECTIVES

During this course, students will…

1. **Recognize and understand the Data life-cycle.** Introduction to problems and methodologies in dealing with real-time data. Working on this project will give students experience in data accessioning, data pre-processing including dealing with messy data and data cleansing, documenting data provenance, and making difficult judgments about current usage models and planning for future maintenance and reuse.

2. **Explain and demonstrate a proficient use of sensor systems.** Students will be taught how to use sensors and micro-controllers (i.e. Arduino) to gather environmental data. Arduino is an open-source electronic prototyping platform using which users can create interactive electronic projects. There are a variety of sensors that can be integrated with the Arduino micro-controller and there are multiple ways of accessing data from the system. Moreover, the platform has its on IDE which helps develop software for analyzing the sensor data in real-time. Students will work with the Arduino system both individually and in groups and learn how to set up a sensor system as well as program to analyze the data. Figure 2 shows a simple set up for measuring temperature and pressure in an office space.

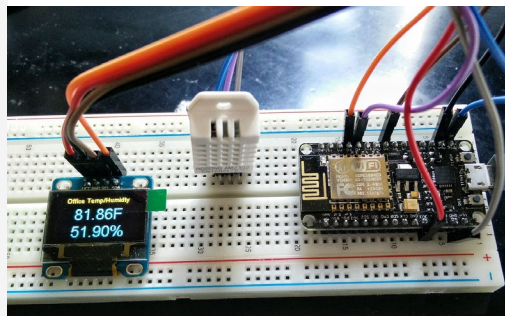*Figure 1 Arduino Platform*   *Figure 2 Temperature and Pressure Experiment*

3. **Scope and compose a research problem.** Study a research problem in a collaborative group. In this stage student groups will be involved in developing proposals to study a research problem, defend the proposal and then implement the proposed project and analyze the results.

4. **Develop skills and familiarity with a range of technologies.** Students will be exposed to various fabrication technologies that are often associated with makerspaces. Additionally, students will engage in a pro-help, pro-question ethos throughout the course.

5. **Conduct data analysis.** Students will deploy their experimental data accession systems and gather data from them in real-time. They will use analytics and visual methods to test hypotheses that they proposed. Students will also verify on the reproducibility of results. Students will learn about how to use tools such as containers (e.g.. docker) and lab note-books (e.g.. Jupyter) to help them solve this problem.

6. **Synthesize and share findings in a project Showcase.** The final stage of the course will be a demonstration of the project. Students will learn how to communicate their results, both in writing a report and making presentations to the class. We will encourage students to go beyond normal experimentations and become true data scientists and take ownership of their project. As a class, we'll also explore opportunities for students to showcase their projects to K-12 students. One idea is to use UNC based initiatives such as the NC Renaissance or Project Uplift and outreach programs such as 'Science Outreach at UNC' to build connections to school students and bring research principles and scientific discovery from the laboratory into the K-12 classrooms.

COURSE MATERIALS

Reading materials will be made available in the "Resources" tab in Sakai or are hyperlinked in the syllabus.

ASSIGNMENTS AND GRADING

Class Attendance & Participation (20%)
Students are expected to participate actively in class discussions throughout the class. Attendance is required. Every three unexcused absences will drop a grade. For each class, there will be some material to read before coming to class. One or two students will be randomly asked to lead discussion on the topics covered by the reading material. Rest of the class will participate in the discussions. Apart from this, as the class proceeds, we will be looking for questions, comments and a lively dialogue on the material presented by the instructor. Don't be afraid of asking questions, raising doubts or making a point. We want everyone to participate and to equally guide the discussions.

Weekly Flash Projects (20%)
Throughout the course, students will complete a series of flash projects: a short burst making activity where students learn a skill and produce a small deliverable over the course of ~two weeks. The flash projects are comprised of two parts: the deliverable and a ~100-word making reflection (posted in the class forum in Sakai).

Exams (10%)
There will be one exam, a final.

Project assignment and showcase presentation (50%)
There will be a term-long assignment related to data science and making. These assignments will involve group participation and will require research and writing on topic-related areas. More information will be provided about the assignment in class.

GRADING POLICIES
The following grade scale will be used as a guideline (the final grade scale may differ) for undergraduates:

- A 100-90%
- B 89-80%
- C 79-70%
- D 69-60%
- F Below 60%

Based on UNC Registrar policy for graduate-level courses:
- H (95-100) "clear excellence", above and beyond what is required
- P (80-94) all requirements satisfied at entirely acceptable level
    - (note: this is expected to be the median grade for this course)
- L (70-79) low pass; substandard performance in significant ways
- F (<70) failed; performance that is seriously deficient and unworthy of graduate credit

REQUESTS FOR EXTENSIONS OR ABSENCES
If a serious illness or other events prevents you from coming to any of the classes, send your instructors an e-mail message, or a friend with a note, describing your condition before the class or as soon as possible.

ACCESSIBILITY RESOURCES AND SERVICES
The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in difficulties with accessing learning opportunities. All accommodations are coordinated through the Accessibility Resources and Service Office. See the ARS Website for contact information: accessibility.unc.edu. Relevant policy documents as they relation to registration and accommodations determinations and the student registration form are available on the ARS website under the About ARS tab. Honor Code All students are expected to follow the Honor Code: http://honor.unc.edu/.

SILS DIVERSITY STATEMENT

In support of the University's diversity goals and the mission of the School of Information and Library Science, SILS embraces diversity as an ethical and societal value. We broadly define diversity to include race, gender, national origin, ethnicity, religion, social class, age, sexual orientation and physical and learning ability. As an academic community committed to preparing our graduates to be leaders in an increasingly multicultural and global society we strive to:

- Ensure inclusive leadership, policies and practices;

- Integrate diversity into the curriculum and research;

- Foster a mutually respectful intellectual environment in which diverse opinions are valued;

- Recruit traditionally underrepresented groups of students, faculty and staff; and

- Participate in outreach to underserved groups in the State.

The statement represents a commitment of resources to the development and maintenance of an academic environment that is open, representative, reflective and committed to the concepts of equity and fairness.

COUNSELING AND PSYCHOLOGICAL SERVICES

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://caps.unc.edu/ or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more. (source: Student Safety and Wellness Proposal for EPC, Sep 2018)

TITLE IX RESOURCES

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – Adrienne.allison@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.

BASIC NEEDS SECURITY

Any student who faces challenges securing their food or housing and believes this may affect their performance in the

course is urged to contact the Dean of Students for support. Also, please me if you are comfortable in doing so. This will enable me to provide any resources that I may possess.

UNIVERSITY HONOR SYSTEM

The University of North Carolina at Chapel Hill has had a student-administered honor system and judicial system for over 100 years. Because academic honesty and the development and nurturing of trust and trustworthiness are important to all of us as individuals, and are encouraged and promoted by the honor system, this is a most significant University tradition. More information is available at http://www.unc.edu/depts/honor/honor.html. The system is the responsibility of students and is regulated and governed by them, but faculty share the responsibility and readily commit to its ideals. If students in this class have questions about their responsibility under the honor code, please bring them to me or consult with the Office of the Dean of Students. The web site identified above contains all policies and procedures pertaining to the student honor system. We encourage your full participation and observance of this important aspect of the University.

SOCIAL MEDIA, CLASS PHOTOGRAPHY, & RESEARCH
Currently there is a limited number of LIS courses that focus on makerspaces. As a researcher in this domain, I may document happenings in the class by taking photos of guest presenters, workshops, and projects. I will always ask for permission to take photos and/or to share projects beforehand.

MASK USE STATEMENT
Community Standards in Our Course and Mask Use. This fall semester, while we are in the midst of a global pandemic, all enrolled students are required to wear a mask covering your mouth and nose at all times in our classroom. This requirement is to protect our educational community -- your classmates and me – as we learn together. If you choose not to wear a mask, or wear it improperly, I will ask you to leave immediately, and I will submit a report to the Office of Student Conduct. At that point you will be disenrolled from this course for the protection of our educational community. Students who have an authorized accommodation from Accessibility Resources and Service have an exception. For additional information, see https://carolinatogether.unc.edu/community-standards/#chapter-2

COURSE SCHEDULE (TENTATIVE)
Note: Tuesday classes = Zoom | Thursday classes = Manning 030

Date		Theory (Zoom)	Practical – Bring Laptop! (Manning 014)	Flash Projects(FP) and Term Project (TP)
WEEK 1	Aug 19 Thurs.	Course overview and introduction		Complete CURE pre-course survey
WEEK 2	Aug 24 Tues.	What is Data?		
	Aug 26 Thurs.		Makerspace orientation Design Thinking	Complete **BeAM 101**
WEEK 3	Aug 31 Tues.	Smart Cities		
	Sept 2 Thurs.		Arduino lab exercise #1	TP – Group Formation FP1 Start – Arduino
WEEK 4	Sept 7 Tues.	Sensors & Sensor Systems		
	Sept 9 Thurs.		Arduino lab exercise #2	
WEEK 5	Sept 14 Tues.	Data Analytics		TP- Proposal Submission Start working on project
	Sept 16 Thurs.		Arduino lab exercise #3	FP1 Due -Arduino FP2 Start – 3D Printing Complete **3D Printing BeAM Online**
WEEK 6	Sept 21 Tues.	**Proposal Presentations**		
	Sept 23 Thurs.		Arduino lab exercise #4 3D Printing	Begin (preliminary) data collection
WEEK 7	Sept 28 Tues.	Ethics and critical making		
	Sept 30 Thurs.		3D Modeling with David Romito, BeAM Makerspace	Deploy project
WEEK 8	Oct 5 Tues.	Data visualization with Professor Laura Kurztberg, FIU		FP2 Due - 3D Printing FP3 Start - Laser Cutting Complete **LaserCutting BeAM Online**
	Oct 7 Thurs.		Arduino lab exercise #5 Creating lasercutter files	

			with Anna Engelke, BeAM Makerspace	
WEEK 9	Oct 12 Tues.	**TBD**		
	Oct 14 Thurs.		Arduino lab exercise #6	FP3 Due – Laser Cutting
WEEK 10	Oct 19 Tues.	**PROJECT CHECK-IN & PEER REVIEW**		
	Oct 21 Thurs.	**FALL BREAK**		
WEEK 11	Oct 26 Tues.	**TBD**		
	Oct 28 Thurs.		Arduino lab exercise #7	Complete data collection
WEEK 12	Nov 2 Tues.	**PROJECT CHECK-IN & PEER REVIEW**		
	Nov 4 Thurs.		Open Lab In-class working session	Complete data analysis
WEEK 13	Nov 9 Tues.	**PROJECT CHECK-IN & PEER REVIEW**		
	Nov 11 Thurs.		Open Lab In-class working session	Prepare project presentation
WEEK 14	Nov 16 Tues.	**PROJECT SHOWCASE**		
	Nov 18 Thurs.			
WEEK 15	Nov 23 Tues.			
	Nov 25 Thurs.	**THANKSGIVING BREAK**		
WEEK 16	Nov 30 Tues.	The future of data science and makerspaces Final exam overview		