

**MSYM 492/892 Special Topic in in Agricultural Engineering
Technologies and Techniques in Digital Agriculture
Course Syllabus
Spring 2022
Biological Systems Engineering
University of Nebraska-Lincoln**

Course Description

This 3-credit hour course provides an overview of the technologies and techniques to support digital crop and livestock production and research, from a perspective of data lifecycle – from data generation to data gathering and storage, to data processing, visualization, and analysis for decision makings.

Topics will cover:

- Common types of data generated or available in agricultural systems, and common sensors, equipment, machineries, and public sources to generate or access those data. For example, the weather, soil, crop growth status, and application data in crop production.
- How are data gathered or transmitted from distributed sources to a centralized repository? For example, soil moisture sensors with the Internet of Thing (IoT) technology.
- How are the data organized and structured in the centralized repository? For example, how can the various attributes of soil and crop data be organized in a database.
- Importance and methodologies to exam data quality and implement data cleaning if necessary. For example, cleaning yield data collected from a combine.
- With targeted objectives in mind, how can we process and model the data to reveal the underline patterns, to help automating the management processes, or to help with decision makings for specific management goals? For example, using the animal feeding and behavioral data to determine animal health and growth status as well as management strategies.

Students will gain hands-on experience in laboratory exercise to work on practical or commercial sensors/equipment and real datasets collected in crop and livestock productions to build confidence for their future careers.

Students will also get familiar with open-source programming software such as Python working together with classical software such as Excel and ArcGIS for automated batch data processing, visualization, and modeling.

Learning Outcomes

Upon completion of this course students should:

- Be able to identify various types of data available in agricultural production and choose the appropriate ones to serve specific needs.
- Be able to design methods for data gathering, transmission, management and sharing technologies and techniques.
- Be able to implement data analytics with appropriate software and models to obtain useful information that can lead to actionable decision makings.
- Be able to identify and maximize the information that can be extracted from the datasets to serve the needs.

Class Administration

Hours and Location:

Tuesday, 2:00-5:00 PM; Splinter Laboratory 102

Instructor:

Dr. Yeyin Shi

Office:

213 Chase Hall

Email:

yshi18@unl.edu

(Note: when email, please use “MSYM 492 892 – ” in email subject)

Teaching Assistant

Puranjit Singh

Email:

psingh24@huskers.unl.edu

Office Hours:

Friday, 1:00-2:00 PM, 018 Chase Hall basement (please email Puranjit if the door is locked); or by appointments Zoom: <https://unl.zoom.us/my/psingh24>

Class Resources

There is no required textbook for this class. Class slides and other materials will be posted on Canvas.

Projects / Assignments

There are four Projects/Assignments associated with each of the four case studies throughout the semester, each worth 100 points, in total 400 points. These assignments are for students to practice problem solving skills with a comprehensive view of a problem and system approaches. An assignment is due in Canvas a week from it being assigned.

There are another 100 points related with your participation and attendance in class discussions, teamwork, and Canvas discussion activities. This will be evaluated by the instructor at the end of the semester.

Students who enroll for the graduate credits (MSYM-892) need to complete a paper at the end of the semester as an additional course requirement. It can be in one of the following three types: (1) a mini review, (2) a research proposal, or (3) an original research paper addressing the data lifecycle and related technologies and techniques in a specific agricultural application. Detailed instructions will be provided separately. This paper worth 200 points.

Grading / Evaluation

1. UNL policies for Pass/No Pass, Incompletes and Withdrawals apply.
2. Your final grade will be based upon your accumulated point total as a percentage of a possible 500 points (700 points for students who enrolled in graduate credits MSYM 892) based on the Grading System in the UNL Undergraduate Bulletin:

A+ 98 - 100%	B+ 88 - 89%	C+ 78 - 79%	D+ 68 - 69%	F 0 - 60%
A 92 - 97%	B 82 - 87%	C 72 - 77%	D 62 - 67%	
A- 90 - 91%	B - 80 - 81%	C - 70 - 71%	D - 60 - 61%	

3. Allocation of points:

Projects	400
Participation & Attendance	100
*Extra requirements for 892 credits	*200
Total	500 (or *700)

Academic Dishonesty: The Code of Conduct published in the UNL Student Handbook concerning academic dishonesty applies. Students are expected to adhere to guidelines concerning academic dishonesty outlined in Section B of the University's Student Code of Conduct <http://stuafs.unl.edu/dos/code>. Students are encouraged to contact the instructor for clarification of these guidelines if they have questions or concerns.

Face Covering Policy:

An individual in this course has a documented need for face coverings to be required in this course. Without divulging personal or identifying information, such a documented need might be that a member of their household is unable to be vaccinated or has a health condition that makes vaccines less effective for them. As a result, the College of has determined that face coverings will be required in this course. If you are unwilling to comply with this requirement, please visit with your advisor about different sections or possible alternative courses that you might take in lieu of this one. Approved by College Dean Tiffany Heng-Moss in December 2021.

Class Attendance Policy: <https://www.unl.edu/facultysenate/policies/Class-Attendance-Policy-081121.pdf> There are 100 points related with your participation and attendance (see sections above).

Accessibility Statement: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented in a timely manner. SSD contact information: 232 Canfield Admin Bldg.; 402-472-3787.

Mental Health and Wellbeing Resources: UNL offers a variety of options to students to aid them in dealing with stress and adversity. Counseling and Psychological & Services (CAPS) is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. Big Red Resilience & Well-Being provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

Emergency Procedures:

Consult UNL emergency planning site for current emergency procedures <https://emergency.unl.edu/>

Tentative Class Schedule

Spring 2022: Tuesday, 1/18/2022 – Friday, 5/13/2022

Date	Lecture Topic	Lab Topic	Assignment
Week 1 (Jan 18 th)	Introduction of the class and digital agricultural.	Getting Python running on your laptop.	
Section 1 – Irrigation Scheduling			
Week 2 (Jan 25)	Introduction of irrigation management system (guest lecture).	Data types. Conditions and loops.	
Week 3 (Feb 1)	Public, private, and sensor generated data in agricultural production.	Data visualization.	Project 1 assigned
Week 4 Feb 8	Project 1 – Irrigation Scheduling, and Q&A for Section 1.	Project 1.	
Section 2 – Fertilizer Management			
Week 5 Feb 15	GIS, geostatistics and spatial data analysis.	Numerical data processing.	Project 1 due a day before
Week 6 Feb 22	Introduction of fertilizer management system (guest lecture).	Tabular and matrix data processing.	
Week 7 Mar 1	Satellite and aerial imagery.	Agricultural image processing.	Project 2 assigned
Week 8 Mar 8	Project 2 – Spatial data analysis for N management, and Q&A for Section 2.	Project 2.	
Week 9	Spring Break, no class		
Section 3 – Other Important Technologies			
Week 10 Mar 22	Database.	MySQL	Project 2 due a day before.
Week 11 (Mar 29)	Blockchain	Build a mini cloud-based database.	Project 3 assigned.
Week 12 (Apr 5)	Project 3 – Database, and Q&A for Section 3.	Project 3.	
Week 13 (Apr 12)	IoT based data gathering and transmission.	Create your own IoT.	Project 3 due a day before.
Section 4 - Livestock and Pasture Management			
Week 14 (Apr 19)	Introduction of precision rangeland management system (guest lecture).	Forage biomass analysis	
Week 15 (Apr 26)	Introduction of confined precision livestock management system (guest lecture).	Animal behavior abnormality detection/modeling	Project 4 assigned.
Week 16 (May 3)	Project 4 – Livestock management, and Q&A for Section 4.	Project 4.	
Week 17 (May 13)	No class.	No class.	- Project 4 due a day before. - Graduate credit extra requirements due by the end of this week.