PAG 455 – APPLICATIONS OF BIG DATA IN PRECISION AGRICULTURE

BASIC INFORMATION

Course prefix, catalog number, and title: PAG 455 - Applications of Big Data in Precision Agriculture
Number of credits: 3
Term and year: Fall/2021
Time and place: Wednesday & Friday 10:00 am – 10:50 am – Lecture / Location: ABEN 208
   and/or via Zoom/Teams
   Lab: Friday 1:00 pm – 3:30 pm/Location: ABEN, Room 210B and/or Zoom

Instructor's name: Dr. Paulo Flores
Office location: ABEN 119
Office hours: Wednesday and Friday, 11:00 am – 12:00 pm. Students can also meet instructor
   by appointment. Drop-ins are acceptable at other times but instructor availability
   cannot always be guaranteed. Students are also welcome to call office number or
   Zoom, request a Zoom meeting, or send questions via e-mail.
Phone Number: 701.231.5348
Email Address: paulo.flores@ndsu.edu
Zoom PMI : 573.779.7527

Health and Safety Expectations

Masks will be required in all classroom settings whether such classes are credit, non-credit, training sessions, etc. Faculty members who are able to maintain social distance from students may remove their masks during the class for purposes of being more easily heard. In addition, individuals should feel authorized to kindly ask other people who are visiting their work space (*e.g.,* offices, cubicles, etc.) to wear a mask.
If you fail to properly wear a face covering, you will not be admitted to the classroom. The following will be used as needed: referral to Dean of Students Office or administrative removal from class.
• Students who cannot wear a face covering due to a medical condition or disability may seek an accommodation through the Disability Services (701-231-8463; https://www.ndsu.edu/disabilityservices/).
• In accordance with NDSU Policy 601, failure to comply with instructions, including the mask requirement, may be handled according to the Code of Student Conduct resolution process and may result in disciplinary sanctions.

Mask guidance

We are labeled as a high transmission county, which means all people (vaccinated and *especially* unvaccinated/partially vaccinated) should wear a mask in public indoor settings, particularly if individuals are at risk, have someone in their household who is at increased risk of severe disease, or someone in their household who is not fully vaccinated (e.g. children under 12). Additionally, per President Bresciani's 8/17/21 email, NDSU is requiring masks in all classroom settings. Instructors who are able to maintain social distance from

students may remove their masks during the class to be heard more easily. (Sources: https://www.osha.gov/coronavirus/safework, https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html, https://www.health.nd.gov/ndhelps)

Close contact with infected individual
A close contact is when a person who has been within 6 feet of an infected person for a cumulative 15 minutes in a 24 hour period. The CDC states that someone who is **unvaccinated** and has had a close contact must quarantine regardless of masking status, while the North Dakota Department of Health states any close contact is exempt from quarantining if both parties were masked. (Source: https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html , https://www.health.nd.gov/what-do-if-you-are-close-contact)

Testing and quarantine guidance
If you have had a close contact and are potentially exposed to someone with suspected or confirmed COVID-19, **always** get tested 3-5 days following the exposure regardless of vaccination status.
In Fargo, testing & screening are both provided at 3051 25th Street South, Fargo, Suite K, which is located in the Family Fare strip mall, between the Hi-Ho Burgers & Brews and Grand Junction Grilled Subs restaurants. They offer multiple testing options, including the rapid test.
In Moorhead, testing is available at the former Thomas Edison Elementary School, 1110 S. 14th Street, Moorhead. The results will be provided via email approximately 48-72 hours after testing.

Until you get your test results:
Fully vaccinated people:
- Do NOT need to quarantine after exposure unless they are exhibiting symptoms.
- Should wear a mask in public indoor settings for 14 days following exposure or until their test is negative (if not already masking consistently).

Unvaccinated or partially vaccinated people:
- Should quarantine for 14 days, but may shorten their quarantine under certain circumstances.
  - You may quarantine for 10 days without testing if you experience no symptoms during that time.
  - You may quarantine for 7 days with a negative test and no symptoms exhibited during that time.

If you test negative:
- You do not need to quarantine. Continue safe practices and watch for symptoms.

If you test positive:
- Regardless of your vaccination status, you need to go into isolation.
- People who are in isolation should stay home until it's safe for them to be around others. At home, anyone sick or infected should separate from others, stay in a specific "sick room" or area, and use a separate bathroom (if available).
- Monitor your symptoms. If you have an emergency warning sign (including trouble breathing), seek emergency medical care immediately.
- If you exhibit symptoms, you can be around others after:

- o 10 days since symptoms first appeared **and**
- o 24 hours with no fever without the use of fever-reducing mediations **and**
- o Other symptoms of COVID-19 are improving.
- If you exhibited no symptoms, you can be around others after:
  - o 10 days since you had a positive viral test for COVID-19

If you are exposed in any scenario, continue to self-monitor your symptoms for 14 days. (Sources: https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html, https://www.health.nd.gov/what-do-if-you-are-close-contact)

Faculty and student considerations

If quarantined, students should receive support through virtual learning options. Similarly, alternative teaching and work-from-home options for faculty, instructors, and staff should be provided to those who are well enough to continue working remotely. Flexible sick leave and supportive policies should be considered. (Source: https://www.cdc.gov/coronavirus/2019-ncov/community/colleges-universities/ihe-testing.html)

Communication

➢ The primary method by which course-related information will be communicated is during class. Reminders, notification of any schedule or assignment changes will be communicated through NDSU email and posted on Blackboard announcements page.

➢ Your NDSU email address is the official route for information.

Technology Concerns

For any technology concern, please contact the IT Help Desk.

Email: ndsu.helpdesk@ndsu.edu

Call: 701-231-8685 (option 1)

BULLETIN DESCRIPTION

The course is designed to introduce students to basics concepts regarding big data, how big data relates to precision agriculture, and how big data analysis approaches are using precision agriculture related data to enhance crop management and production. The course is offered as two 50-minute lectures and a 2.5 hour lab per week.

PREREQUISITES

PAG 215 – Mapping of Precision Ag Data

TEXTBOOK

None.

RECOMMENDED STUDENT RESOURCES

- Pattnaik, P.K., Kumar, R., Pal, S., Panda, S.N.; IoT and Analytics for Agriculture. Springer, 2020. ISBN: 978-981-13-9176-7. (Recommended)

- Pattnaik, P.K., Kumar, R., Pal, S. Internet of Things and Analytics for Agriculture, Volume 2. Springer, 2020. ISBN: 978-981-15-0662-8. (Recommended)

COURSE OBJECTIVES

Objectives

The course objective is to introduce students to the basics of big data, how big data datasets are been generate from precision agriculture related equipment and devices, some of the challenges related to use of big data in agriculture, what are some of the approaches being used to analyze that data, and how that data is being used to drive crop management decision in different segments related to agriculture.

Outcomes

Students will:
- Become familiar with basic concepts regarding big data in agriculture.
- Gain a better understanding on how data being collected by different sensors and equipment at the farm level are being used on big data analysis to gain more insight regarding the farm.
- Understand the limitations to use of big data analysis in precision agriculture.
- Learn how big data analytics are been used to drive decisions regarding many areas related to precision agriculture and agriculture in general.

MODES OF PRESENTATION

Lecture with PowerPoint
Guest Speakers (remotely and/or in person)
Articles/papers discussion
Field trips (if possible)

A NOTICE ABOUT COPYRIGHT OF COURSE MATERIALS

Refer to NDSU Policy 190 on Intellectual property.
- In this course recording the lectures is prohibited with your own personal devices (without prior express approval from the instructor).
- In this course recording the lectures for anything other than personal use is prohibited.

BLACKBOARD

Blackboard will be used for announcements, class presentations, and for posting grades.

EVALUATION PROCEDURES AND GRADING CRITERIA

Students will have 7 categories in which they will evaluated in the course. Those categories are as follows.

Category	-------------- % of the total grade* --------------
1. Homework (up to 12)	15
2. Quizzes (unannounced, up to 6)	10
3. Engagement on class discussions	5

4. Labs (projects/reports)	20
5. Exam 1	15
6. Exam 2	15
7. Final exam (comprehensive)	20
Total	100

*Letter grades will be assigned using the following scale: A= 90.0-100%; B= 80.0-89.9%, C= 70.0-79.9%; D= 60-69.9%, and F= less than 60%.

Homework, quizzes, labs, and test scores will be posted on Blackboard for informational purposes only.

Quizzes will be unannounced. Given the current pandemic situation, make-up quizzes might be allowed at the discretion of the instructor, on a case-by-case basis. Similar procedure will be followed to accomodate students that miss a scheduled mid-term exams and/or final exam due to illness or other challenges related to COVID-19.

Due dates for homework and lab reports will be provided with the assignments, and they will be due by 4:30 pm on the day of submission. Late assignments will be accepted with a 10% penalty per NDSU class day, but they will not be accepted after solutions are posted/handed out/discussed or 2 NDSU class days after the original due date. Once again, the instructor will provide flexibility for those students affected by illness or other challenges related to COVID-19.

Students are encouraged to work in groups to complete their homework and lab assignments, which allow for students to learn from each other. Although working groups are encouraged, students are required to turn in individual versions of their assignments. In the case when homework, lab reports, or missed homework and lab report seem to be a "copy" from other individual's assignment, all students involved will receive 0 (zero) points for that assignment.

ASSIGNMENT SUBMISSION

In this course Blackboard will be used as much as possible for assignment submissions (and grading) for all students.
If you are sick, please do not come to class or campus to turn in work. Instead notify the course instructor as soon as practical, so that accommodations can be made.

ATTENDANCE STATEMENT

According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected.
Attendance in classes is expected and important. (The term "class" includes class, online class, laboratory, field trips, group exercises, or other activities related to the course). However, there are instances in which students are unable to attend class, and if those are described in policy 333, then those absences will be excused. Absences not covered under policy 333 are excusable at the discretion of the instructor. However, class policies regarding class absence are provided below.

If a student will be missing class for an event related to university clubs or teams, or other excusable reason to be determined by the instructor, the student must let the instructor know before he/she misses the class. Consideration will be given to those students who have a valid excusable reason when making a determination regarding making up assignments or tests.

- **Students that can not attend the class in-person due to medical condition or other reasons may seek an accommodation through the Disability Services (701-231-8463; https://www.ndsu.edu/disabilityservices/).**
- Please protect your health and the health of others by staying at home if you are sick. Due to the dynamic nature of the pandemic, the instructor will remain flexible and provide accomodations (at his on discretion) for those students affected by Covid-19.

DEAD WEEK POLICY

The NDSU Dead Week policy is available at http://www.ndsu.edu/registrar/dates/deadweek/.

VETERANS AND MILITARY PERSONNEL

Veterans or military personnel with special circumstances or who are activated are encouraged to notify the instructor as early as possible.

AMERICANS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor as soon as possible. The instructor may ask for verification and that, plus other assistance, can be requested from Disability Services in the Lower Level of the NDSU Library (231-8463) http://www.ndsu.edu/disabilityservices/.

APPROVED ACADEMIC HONESTY STATEMENT

All students taking any course in the College of Agriculture, Food Systems, and Natural Resources are under the Honor System (http://www.ag.ndsu.edu/academics/honor-system-1). (The CAFSNR Website is undergoing change and there will be a new web address at some point during the semester). The Honor System is a system that is governed by the students and operates on the premise that most students are honest and work best when their honesty, and the honesty of others, is not in question. It functions to prevent cheating as well as penalize those who are dishonest. It is the responsibility of the students to report any violations of the honor pledge to the instructor, honor commission or the Dean of the College of Agriculture, Food Systems, and Natural Resources.

The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

All participants in this class are subject to NDSU University Senate Policy 158: Acceptable use of Electronic Communications Devices (http://www.ndsu.edu/fileadmin/policy/158.pdf).

As a courtesy to other students and the instructor, all cell phones, iPods, MP3 players, and other electronic devices, except handheld calculators, should be turned off or placed in a vibrate-only mode during class time. Initiating phone calls, text message, or other types of messages during class time -including those to friends, family, classmates, coworkers, or supervisors—is unacceptable unless there is a genuine emergency. Examples of emergencies include weather-related school closing announcements; fire, bomb, or other threats to public safety and well-being; and other incidents in which the NDSU system is or could be activated to provide broadcast messages to the NDSU community.

Use of cell phones or other portable electronic devices for communication, transmission, retrieval, or storage of information during the administration of a test or quiz may be considered an incident of **academic dishonesty**. One exception to this policy is the use of handheld calculators for computational purposes. Use of cell phones or similar devices as a calculator during tests and quizzes will not be allowed because it is difficult to distinguish such activity from sending and receiving text messages, which could obviously be interpreted as a form of academic dishonesty.

IMPORTANT DATES

September 1	Last day to add classes via Campus Connection
September 1	Last day for no-record drop of classes @ 100% refund
September 1	Last day to withdraw to 0 credits @ 100% refund
September 6	Labor Day holiday (no classes/offices closed)
September 7	Financial Aid applied to Student Accounts
September 13	Last day to submit request to audit, pass/fail
October 15	Undergraduate fall graduation application due
October 15	Graduate student Intent to Graduate due
October 15	Grades of Incomplete convert to F
October 28	Spring/ Summer registration begins
November 11	Veteran's Day (no classes/offices closed)
November 12	Last day to drop classes with 'W' record
November 12	Last day to withdraw to zero credits for Fall
November 19	Fall commencement participation deadline
November 24-26	Thanksgiving no classes (offices open on Friday)
December 6-10	Dead Week
December 13-17	Final Examinations
December 17	Commencement

COURSE SCHEDULE/OUTLINE

Tentative lectures schedule

Week	Date	Topics
1	Aug 25	Class introduction
1	Aug 27	Introduction to Big Data
2	Sept 1	Introduction to Big Data
2	Sept 3	Introduction and basics of R programming (Guest Lecture)
3	Sept 8	Big Data and IoT in Agriculture
3	Sept 10	Big Data and IoT in Agriculture
4	Sept 15	Big Data and IoT in Agriculture
4	Sept 17	Big Data and Precision Agriculture
5	Sept 22	Big Data and Precision Agriculture
5	Sept 24	Introduction and basics Python programming
6	Sept 29	Big Data Analytics – Types of Analytics
6	**Oct 1**	**Exam 1**
7	Oct 6	Big Data Analytics – Types of Analytics
7	Oct 8	Challenges for wide application/adoption of Big Data in precision agriculture
8	Oct 13	Challenges for wide application/adoption of Big Data in precision agriculture
8	Oct 15	Seminars topics and groups selection
9	Oct 20	Big Data and machine learning in ag – Guest speaker - Sentera
9	Oct 22	Ethics of using BD and AI in agriculture – paper discussion
10	Oct 27	Big Data in the farm – DYI?
10	Oct 29	Big Data and risk management in agriculture
11	Nov 3	Introduction to parallel computing - Guest speaker
11	**Nov 5**	**Exam 2**
12	Nov 10	Big Data and IoT sensors applications in livestock production
12	Nov 12	Big Data and Blockchain – Agriculture Supply Chain
13	Nov 17	Big Data in agriculture – cloud platforms
13	Nov 19	Machine Learning – Guest Speaker

14	Nov 24	Thanksgiving break – no class
14	Nov 26	Thanksgiving break – no class
15	Dec 1	Student Seminar presentation
15	Dec 3	Guest Speaker
	Dec 8	Student Seminar presentation
	Dec 10	Dead Week (content review)
16	**Dec 15**	**Final Exam**

Tentative labs schedule

Week	Date	Topics
1	Aug 27	Field Trip - Grand Farm visit
2	Sept 3	Introduction and basics of R programming
3	Sept 10	Creating soil fertility maps using R
4	Sept 17	Remote sensing analysis using R
5	Sept 24	Applications ob Big Data in Agriculture - Agrotools
6	Oct 1	Introduction to Python
7	Oct 8	Basics of Python scripting and Python Libraries
8	Oct 15	Remote sensing analysis using Python
9	Oct 22	Guest Speaker
10	Oct 29	Big data and machine learning in agriculture - Corteva
11	Nov 5	High-performance computing (HPC) for precision agriculture (Guest Lecture)
12	Nov 12	Aerial imagery processing using parallel computing
13	Nov 19	Machine learning and big data on HPC systems (Guest Lecture)
	Nov 26	Thanksgiving – no lab
14	Dec 3	Guest Speaker
15	Dec 10	Guest Speaker