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**DATA SCIENCE AND BUSINESS ANALYTICS DEPARTMENT**

**ESI 4011 - Data Analytics for Smart City & Transportation**

**Fall 2020**

**Instructor**

Mostafa K. Ardakani, Ph.D., P.E., PMP

Office: IST Building, Room 2035

Phone: 863-874-8533

Email:Mardakani@floridapoly.edu

**Course Schedule & Location**

* Monday and Wednesday: 5:30 – 6:45 pm [Aug 20, 2020 - Dec 3, 2020]
* Location: IST Building, Room IST-1014

**Class delivery mode/Meeting times expectations**

The course delivery is in FLEX mode, which means students may attend in-person (but not required). Students who do not attend in-person, required to join TEAMS during scheduled class times. The course will be broadcast live too.

**Credit Hours:** 3

**Final Exam**

December 7-11th (*Exact Date To Be Determined*)

**Office Hours**

Online through TEAMS

Monday and Wednesday: 4:00 – 5:20 pm & Friday 11:50 – 12:10 (or by appointment)

**Course Website**

<https://floridapolytechnic.instructure.com/courses/4605>

**Catalog Course Description:** This course focuses on design strategies, simulation techniques, and data analytics to strengthen the knowledge of existing cities, and understand the needs and requirements of future cities through a data driven analysis. Smart cities utilize information and communication technologies to enhance the quality and performance of transportation, utility and energy services from cost and consumption perspectives. The course explains how smart cities operate in a controlled and monitored network environments and discusses techniques to work with data generated by transportation and communication networks, crowd-sensing systems and other relevant technologies.

**Prerequisites:** ESI 3005 - Introduction to Networks and a Connected World; Or, CNT 3004C - Introduction to Computer Networks

**Communication/Computation Skills Requirement (6A-10.030):** No

**Textbooks and Reference Materials**

[Required] Big Data Analytics for Connected Vehicles and Smart Cities, (2017), By: Bob McQueen, ISBN: 978-1630813215

[Additional] Data Analytics for Intelligent Transportation Systems, (2017), Edited by: Mashrur Chowdhury, Amy Apon, Kakan Dey, ISBN:978-0128097151

[Additional] Data Analytics for Smart Cities, (2018), By: Amir Alavi and William G. Buttlar, ISBN: 978-1138308770

**Equipment and Materials**

We will use R software. The software can be downloaded for free via <https://cloud.r-project.org/>. Also, it is available in campus computers. The aim is to learn necessary quantitative analysis of transportation data.

**Course Objectives**

* To examines the current trend for smart cities.
* To understand application of big data analytics to connected vehicles, smart cities, and transportation systems.
* To learn how data analytics can expand the design and engineering of connected vehicles and smart cities.
* To know how smart cities affect the application of advanced technologies in urban areas.

**Learning Outcomes**

Upon completion of this course, students should be able to

1) Understand how connected and autonomous vehicles fit within a smart city.

2) Realize important steps to be taken toward implementing a smart city.

3) Explain a conceptual framework for estimating benefits and costs associated

with smart city transportation services.

4) Analyze some examples of big data from transportation

**Alignment with Program Outcomes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Learning Outcome | | | |
| Data Science Program Student Outcomes | 1 | 2 | 3 | 4 |
| (1) Apply current data science concepts, techniques, and practices to solve complex problems. |  |  |  | X |
| (2) Analyze a given data science problem and formulate a solution in terms of the datasets needed, the techniques required or the technologies to be utilized. |  | X |  | X |
| (3) Communicate effectively insights, analysis, conclusions, or solutions to a diverse audience. | X |  | X |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Learning Outcome | | | |
| Business Analytics Program Student Outcomes | 1 | 2 | 3 | 4 |
| (1) Apply current business analytics concepts, techniques, and practices to solve business problems. |  |  |  | X |
| (2) Analyze a given business problem using appropriate analytics techniques to generate insights and solutions. | X | X |  | X |
| (3) Communicate effectively insights, analysis, conclusions, and solutions to a diverse audience. | X |  | X |  |

**Grading**

* Mid-term (30%)
* Final Exam (30%)
* Quizzes (10%)
* Homework (10%)
* Project (20%) detail will be provided in class and posted on Canvas

The following grading scale applies:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A | 93% – 100% | B | 83% – <87% | C | 73% – <77% | D | 63% –< 67% |
| A– | 90% – <93% | B– | 80% – <83% | C– | 70% – <73% | D– | 60% – <63% |
| B+ | 87% – <90% | C+ | 77% – <80% | D+ | 67% – <70% | F | 0% – <60% |

*Homework:*Homework will be assigned corresponding to the covered chapters/topics. The homework will help students to learn technical aspects of the course. Late submissions will not receive credit; so, please complete and submit them on time. Tentative homeworkers topics are as follows.

HW 1: Value of data in smart city transportation

HW 2: Data management and big data in a transportation context, emphasizing on potentially big data sources

HW 3: Autonomous vehicle and its associated challenges

HW 4: Defining the smart city in the form of 16 smart city transportation services

HW 5: Identifying five possible departure points for a smart city from a transportation perspective

*Quizzes:*The aim is to give students an idea of what to expect on exams and provide early feedback on your progress.

*Project:*Each person needs to submit their final report including the summary of project, literature review, methods and models, results, conclusions and references. All projects will be presented at the end of semester. Detailed instructions with specific guidelines and formatting will be available on canvas. The final report is due on the last day of class. Also, report and presentation rubrics are provided at the end of this syllabus. A list of projects will be provided. Potential topics are as follows.

-Smartphone Technology Integrated with Machine Learning for Airport Pavement Condition Assessment

-Global Satellite Observations for Smart Cities

-Advancing Smart and Resilient Cities with Big Spatial Disaster Data

-Smart City Portrayal: Dynamic Visualization Applied to the Analysis of Underground Metro

-Smart Bike-Sharing Systems for Smart Cities

-Big Data Exploration to Examine Aggressive Driving Behavior in the Era of Smart Cities

**Attendance**

You are expected to attend and participate actively in class. Attendance record will be taken, and participation in class discussions and activities will be monitored. (See also [University Policy](https://floridapoly.edu/wp-content/uploads/FPU-5.0010AP-Student-Attendance-05.28.14-FINAL.pdf)), which reads “Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor.” Attendance in this environment does not, of course, mean actual physical attendance in the classroom, although it may include that.

**Late Work/Make-up work**

Each student must keep current on assignments. Late assignments are not graded, unless permission has been obtained from the instructor in advance.

**Tentative Schedule**

|  |  |  |
| --- | --- | --- |
| **Week** | **Topics** | **Quiz/HW** |
| 1 | Chapter 1: Introduction  Background  Why This Subject and Why Now |  |
| 2 | Chapter 2: Questions to Be Addressed  Overview of the Questions  Safety-Related Questions  Efficiency-Related Questions  User Experience-Related Questions | HW 1 |
| 3 | Chapter 3: What is Big Data  How Is Big Data Measured  What Is Big Data  Challenges  Big Data in Transportation  Transportation Systems Management and Operations | HW 2  Quiz 1 |
| 4 | Chapter 4: Connected and Autonomous Vehicle  What Is a Connected Vehicle?  Connected Vehicle Challenges  What Is an Autonomous Vehicle?  Autonomous Vehicle Challenges  Summary of the Differences between Connected and  Autonomous Vehicles | HW 3 |
| 5 | Chapter 4: Connected and Autonomous Vehicle  Connected and Autonomous Vehicles within a Smart City  The Likely Impact of the Connected and the Autonomous Vehicle on Transportation  Big Data and Connectivity  Connected and Autonomous Vehicles within a Smart City  The Likely Effect of Connected and Autonomous Vehicles on the Automotive Industry | Quiz 2 |
| 6 | Review and Midterm | Quiz 3 |
| 7 | Chapter 5: Smart Cities  What Is a Smart City?  Smart City Objectives  Steps Toward a Smart City  Smart City Frameworks  Evaluating the Effects of Investments  Smart City Challenges  Smart City Opportunities  Lessons Learned from the London Congestion  Charge Project |  |
| 8 | Chapter 5: Smart Cities  Smart City Challenges  Smart City Opportunities  Lessons Learned from the London Congestion Charge Project  The Sentient City | HW 4 |
| 9 | Chapter 6: What are analytics  Why Analytics Are Valuable  Smart City Services Analytics  Analytical Performance Management for a Smart City  How Do Analytics and Data Lakes Fit Together?  How to Identify Data Needs Associated with Analytics |  |
| 10 | Chapter 7: Practical Application of Analytics to Transportation  Integrated Payment Systems  Integrated Payment System Analytics and Their Practical Application  MaaS  MaaS Analytics and Their Practical Application | Quiz 4 |
| 11 | Chapter 7: Practical Application of Analytics to Transportation  Integrated Payment Systems  Traffic Management and Smart Cities  Traffic Management Analytics and Their Practical Application  Transit Management and Smart Cities  Transit Management Analytics and Their Practical Application  Performance Management and Smart Cities  Performance Management Analytics and Their Practical Application |  |
| 12 | Chapter 8: Transportation Use Cases  Smart City Transportation Use Case Examples | HW 5 |
| 13 | Chapter 9: Building a Data Lake  Definition of a Data Lake  How a Data Lake Works  Value of a Data Lake  Challenges  An Approach to Building a Data Lake |  |
| 14 | Chapter 11: Benefit and Cost Estimation for Smart City Transportation Services  Smart City Cost and Benefit Estimation  Assumed Configurations for Cost Estimation Purposes  Cost Estimates for Smart City Transportation Services  Smart City Transportation Service Cost Summary  Estimated Benefits for Smart City Transportation Services  Smart City Transportation Services Cost and Benefits Summary | Quiz 5 |
| 15 | Review and Project Presentations |  |

*Chapter numbers are based on the required reference book.*

*This table might be modified as required by the progression of the class.*

**Academic Support Resources**

* Library: Students can access the Florida Polytechnic University Library through the University website and [Canvas](https://floridapolytechnic.instructure.com/login), on and off campus. Students may direct questions to Academic Success Center [success@floridapoly.edu](mailto:success@floridapoly.edu) or by email, [library@floridapoly.edu](mailto:library@floridapoly.edu).
* ASC: The Academic Success Center, located in the Commons and at ASC East, provides a range of services. Students may direct questions to [success@floridapoly.edu](mailto:success@floridapoly.edu).

**University Policies**

* **Covid-19 Statement**: Regardless of the mode of course delivery, all Florida Poly students are asked to make a [Campus Commitment](https://floridapoly.edu/coronavirus/campus-commitment.php) demonstrating respect and consideration for themselves or others, and for the people they care about. This Campus Commitment includes monitoring one’s health and seeking medical care when appropriate; wearing face-coverings and respecting social-distancing, especially in the classroom and in gatherings; washing one’s hands frequently (and when not possible using hand-sanitizer); following medical guidance; and participating in keeping shared spaces clean. If you are experiencing any symptom(s) of COVID-19 outlined by the CDC, you must stay home or in your residence hall room and immediately contact the associate director of campus wellness management at 863-874-8599 or email [care@floridapoly.edu](mailto:care@floridapoly.edu).

*Basic rules for in the classroom, IST, and Campus*:

1. You MUST wear your face-covering during class and throughout the building at all times.
2. Absolutely **no eating or drinking** during class.
3. Leave the furniture on its correct floor markings; if the furniture is moved, please return it to those markings.
4. “Take-Two”: Whenever possible, clean your space with a sanitizing wipes (take two) before you start and when you are finished with class.
5. Do not remove sanitizing wipes or hand sanitizers from their set locations—they are put there for everyone.
6. Follow directional signs throughout the buildings and respect appropriate social-distancing.
7. Study hard and engage with all of your courses!

* **Reasonable Accommodations**: Florida Polytechnic University is committed to assisting students with disabilities and offering reasonable accommodations to those with documented eligibility. The Office of Disability Services (ODS) coordinates accommodations for students with disabilities in accordance with the ADA Amendments Act of 2008 (ADAAA), the Americans with Disabilities Act of 1990 (ADA), and Section 504 of the Rehabilitation Act of 1973. Reasonable accommodations are determined on an individual basis through an interactive process between you, ODS, and your instructor(s). If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course and communicate with your instructor about your approved accommodations at your earliest convenience. If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible.

The Office of Disability Services (ODS):

DisabilityServices@floridapoly.edu

(863)874-8770

ASC East building

[ODS website](https://floridapoly.edu/student-affairs/health-wellness/disability-services.php): www.floridapoly.edu > Student Affairs > Health Wellness > Disability Services

* [Accommodations for Religious Observances, Practices and Beliefs](https://floridapoly.edu/wp-content/uploads/FPU-3.009-Reasonable-Accommodations-6.22.17.pdf)
* **Title IX**: Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sex discrimination and sexual misconduct, including sexual harassment, sexual assault, dating violence, domestic violence and stalking. It is important for you to know that there are resources available if you or someone you know needs assistance. You may speak to your professor, but your professors have an obligation to report the incident to the Title IX Coordinator. It is an educational goal that you feel able to share information related to your life experiences in classroom discussions and in one-on-one meetings. However, it is requirement for university employees to share information with the Title IX Coordinator regarding disclosure. However, please know that your information will be kept private to the greatest extent possible. You will not be required to share your experience. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Florida Polytechnic University [Ombuds Office](https://floridapoly.edu/ombuds/index.php), BayCare’s Student Assistance Program, 1-800-878-5470 and locally within the community at [Peace River Center](https://www.peacerivercenter.org/services/victim-services/), 863-413-2707 (24-hour hotline) or 863-413-2708 to schedule an appointment.
* **Academic Integrity**: All students must commit to the highest ethical standards in completion of all academic pursuits and endeavors, whether in classroom or online environments: [Academic Integrity](https://floridapoly.edu/wp-content/uploads/2017/07/FPU-5.005-Academic-Integrity-7.29.14.pdf)

***Important Dates***

August 20 Th Classes Begin

September 7 M Labor Day Holiday - No Classes

November 11 W Veteran’s Day Holiday (Observed) - No Classes

November 25-27 W-F Thanksgiving Holiday Break - No Classes

November 18 W Withdrawal Without Academic Penalty (W assigned)

December 3 Th Last Day of Classes

December 4-5 F-Su Reading Days - No Classes

December 7-11 M-F Final Exams

December 16 W Final Grades Available Online

***Sample Rubric for Report and Presentations***

The­ final presentations and reports will be evaluated using the rubrics.

**Report Rubric**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Objective** | **Category** | **Below Expectations** | **Weak** | **Average** | **Good** | **Excellent** |
| **Score** | **1** | **2** | **3** | **4** | **5** |
| Students can write professional quality documents | Introduction | Opening is off-topic and inappropriate to the purpose, not concise and no clarity | Opening is somewhat related to the topic and appropriate to the purpose but is not concise and clear | Opening is related to the topic and appropriate to the purpose. Somewhat clear and concise | Opening is related to the topic and appropriate to the purpose. Clear and concise | Strong opening that is clear and concise |
| Organization | Disorganized; incorrect format; unclear direction | Somewhat organized; incorrect format; unclear direction | Organized; correct format; unclear direction | Organized; correct format; clear direction | Correct formatting, strong clarity and organization in the development of main points |
| Literature Review | Does not present information from any source | Presents information from irrelevant sources representing limited points of view/approaches | Presents information from relevant sources representing limited points of view/approaches | Presents in-depth information from relevant sources representing limited points of view/approaches | Synthesizes in-depth information from relevant sources representing limited points of view/approaches |
| Analysis | Incorrect, Irrelevant, no supporting evidence | Correct, irrelevant, no supporting evidence | Correct, relevant, no supporting evidence | Relevant and correct with supporting evidence | Relevant, correct, complete, incorporates innovative insights |
| Next Steps | Missing or content does not support conclusion | Conclusion irrelevant to the findings | Conclusion somewhat relevant to the findings | Conclusion relevant to the findings | Strong conclusion that is clear, complete and compelling |
| Grammar & Spelling | Uses language that often impedes meaning due to errors | Uses language that often sometimes meaning due to errors | Uses language that generally conveys meaning to readers with clarity, although writing includes some errors | Uses straightforward language that conveys meaning to readers. Language has few errors | Uses graceful language that communicates meaning to readers with clarity and fluency and is virtually error free |
| Reference Style (APA) | Did not follow APA style | Numerous errors in APA style, did not cite sources correctly, formatting issues | Some errors in APA style, cited correctly but formatting issues persist | Minimum errors in style and formatting but does not detract from readability | No errors in APA style |
|  |  |  |  |  |  |

**Presentation Rubric**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Objective** | **Category** | **Below Expectations** | **Weak** | **Average** | **Good** | **Excellent** |
| **Score** | **1** | **2** | **3** | **4** | **5** |
| Students can demonstrate mastery of communication technology | Use of Media | Lack of media detracts from the presentation objective | Misuse of media that detracts from the presentation objective | Use of media barely supports and contributes to the presentation objective | Use of media supports and contributes to the presentation objective | Use of media supports, clarifies and reinforces the presentation objective |
| Quality of Slides | Very poor quality. Not enough or too much colors, fonts and animations that detract from project objective | Poor quality. Not enough or too much colors, fonts and animations that detract from project objective | Fonts, colors and animations barely support the presentation objective | Fonts, colors and animations support the presentation objective | Fonts, colors and animations support, clarify and reinforce the presentation objective |
| Students can develop and deliver a compelling oral talk with relevant facts and information | Opening statement | Opening is off-topic and inappropriate to the purpose, not concise and no clarity | Opening is somewhat related to the topic and appropriate to the purpose but is not concise and clear | Opening is related to the topic and appropriate to the purpose. Somewhat clear and concise | Opening is related to the topic and appropriate to the purpose. Clear and concise | Strong opening that is clear and concise |
| Organization | Disorganized; incorrect format; unclear direction | Somewhat organized; incorrect format; unclear direction | Organized; correct format; unclear direction | Organized; correct format; clear direction | Correct formatting, strong clarity and organization in the development of main points |
| Literature Review | Does not present information from any source | Presents information from irrelevant sources representing limited points of view/approaches | Presents information from relevant sources representing limited points of view/approaches | Presents in-depth information from relevant sources representing limited points of view/approaches | Synthesizes in-depth information from relevant sources representing limited points of view/approaches |
| Analysis | Incorrect, Irrelevant, no supporting evidence | Correct, irrelevant, no supporting evidence | Correct, relevant, no supporting evidence | Relevant and correct with supporting evidence | Relevant, correct, complete, incorporates innovative insights |
| Next Steps | Missing or content does not support conclusion | Conclusion irrelevant to the findings | Conclusion somewhat relevant to the findings | Conclusion relevant to the findings | Strong conclusion that is clear, complete and compelling |
| Timing | Presentation is too short, insufficient coverage of material | Presentation is too long. Unable to cover all the material | Able to cover all the material within five extra minutes | Utilizes allotted time to provide sufficient coverage of material | Well-paced coverage of material within the allotted time |
| Students can deliver an oral talk with clarity and appropriate poise | Delivery Techniques | Does not participate in the oral presentation | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable. | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative. | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable. | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident. |