

IS4242

INTELLIGENT SYSTEMS & TECHNIQUES

L0 – ADMINISTRATION

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About Me

- ▶ Assistant Professor
 - ▶ DISA < SoC < NUS
- ▶ Research Interests: Economics of AI, App Ecosystem, Network Analysis
- ▶ Methods: Econometrics, NLP, Reinforcement Learning, Graph Analytics
- ▶ Website: <https://askaranam.github.io>
- ▶ Education
 - ▶ Ph.D. Economics of Info. Systems, UT Austin
 - ▶ M.S. Economics (Major: Econometrics), UT Austin
 - ▶ M.Sc. (Tech) Information Systems, BITS Pilani

Aim of this Module

- ▶ Understand how various business problems can be solved using (data-driven) intelligent systems
 - ▶ What are general business problems faced by managers or policy makers
 - ▶ How to design intelligent systems that *leverage* data to support decision making
- ▶ Acquire ability to *model* a business problem, and *build and evaluate* these models using Python libraries
- ▶ Provides *practical* knowledge on a *breadth* of techniques used in intelligent systems

What are Intelligent Systems?

- ▶ No universal definition
- ▶ Online search:
 - ▶ “computer-based system that can *represent, reason about, and interpret data*”
 - ▶ “machines that *perceive and respond to the world* around them”
 - ▶ “autonomous systems that process information to perceive, act and learn in complex environments”

Examples of Intelligent Systems

- ▶ Automatic Vacuum Cleaners
- ▶ Chat bots
- ▶ Automatic speech recognizer
- ▶ Personalized recommendation systems
- ▶ Stock price forecasters
- ▶ Disease risk predictors
- ▶ Face recognition systems
- ▶ ...

Examples of Intelligent Systems: Applications

- ▶ Navigation in Google Maps
- ▶ Smart replies in Gmail
- ▶ Video recommendations in Netflix
- ▶ Facebook picture tagging

▶ Even these:



<https://thispersondoesnotexist.com>

This Module

- ▶ Solve business problems using intelligent systems
 - ▶ Business problems \mapsto ML/Optimization Models
- ▶ Overview of some fundamental business problems faced by managers
- ▶ Model them as ML/Optimization models
- ▶ Application (build and evaluate) of these models using real world examples

How is it different?

Other Similar Courses	Difference
<ul style="list-style-type: none">▶ Machine Learning▶ Computational Methods for Business Analytics▶ Introduction to Optimization▶ Decision Making Methods and Tools▶ Predictive Data Analytics	<p>All these modules are focused on methodology and cover many algorithms in detail</p> <p>In this module, we will learn:</p> <ul style="list-style-type: none">▶ How to model a business problem (requiring intelligent systems) using ML and/or optimization▶ How to build simple prototypes of ML models▶ Some of these techniques (not all)

Module Content

- ▶ Examples and case studies of business/decision-making problems and how they are addressed using Machine Learning/ Optimization models
- ▶ Lectures:
 - ▶ Discuss business use cases
 - ▶ Conceptual understanding of Models & Algorithms
- ▶ Tutorials:
 - ▶ Applications
 - ▶ Use of Python libraries (numpy, pandas, scikit-learn, pytorch) for basic and advanced data analysis and building Machine Learning models

Prerequisites

- ▶ Mathematical Knowledge:
 - ▶ Course assumes high level of mathematical and statistical maturity
 - ▶ E.g.: Linear Algebra, mathematical notation (context related), etc.
 - ▶ E.g.: Mean, variance, independence, statistical significance, hypothesis testing, etc.
- ▶ Programming Language: Python
 - ▶ Assume you've working knowledge
 - ▶ Know basic programming concepts like iteration and recursion
 - ▶ You know how to set up your working environment and debug your code
- ▶ Courses: refer to course registration website

Learn Python

- ▶ Official Documentation
 - ▶ <https://docs.python.org/3/>
- ▶ Python for Java programmers
 - ▶ <https://lobster1234.github.io/2017/05/25/python-java-primer/>
 - ▶ https://github.com/akashp1712/python-cheat-sheets/blob/master/Python_for_Java_developers_cheat_sheet.pdf
- ▶ Crash Courses
 - ▶ 30 minutes: <https://www.programiz.com/python-programming/tutorial>
 - ▶ 10 minutes: <https://www.stavros.io/tutorials/python/>

Mode of Teaching: Face-to-Face

- ▶ **Lecture** : Tuesdays 4 – 5:30 PM at LT-18 (don't be late!)
- ▶ **Tutorials**:
 - Yash Sinha(Tuesday: 6 – 7 PM and Wednesday: 2:00 – 3:00 PM)
 - ▶ Tutorials start from Week - 2
 - ▶ Sign up for actual tutorial session, that you're going to attend
 - ▶ Please email me if there are any issues
- ▶ **Office/Consultation Hours**:
 - ▶ Aditya (Instructor), karanam@nus.edu.sg, Wednesday, 5:30- 6:30 pm (over zoom)
 - ▶ Zoom link: <https://nus-sg.zoom.us/j/aditya.karanam>
 - ▶ Discuss recurring questions on piazza
 - ▶ I can also redo specific parts of the lecture, if you need (email me accordingly)

Recordings of Lectures/Tutorials

- ▶ Face-to-face
 - ▶ “... *participate fully in university life and come back to face-to-face classes for all your [courses], except the lectures of those courses in which instructors are developing Blended Learning as part of university plan*”
 - ▶ “... *instructors are no longer obligated to make video recordings of their classes or to set up hybrid arrangements. We have discussed and explained the key considerations for this to the NUS Students’ Union (NUSSU) previously. Thus, if you are not able to attend classes due to valid reasons, including COVID-19, please discuss with your course instructor how to proceed.*”
- ▶ Lecture recording for contingency purposes only, will be posted onto canvas the next day
 - ▶ Recordings will be available from Week – 2

Course Management Systems

- ▶ Canvas (official):
 - ▶ Announcements/Admin related posts are made in Canvas
 - ▶ Enable email notifications!
- ▶ Piazza (discussion forum):
 - ▶ <https://piazza.com/nus.edu.sg/fall2023/is4242>
 - ▶ Post questions/discussions to Piazza
 - ▶ Please don't give away answers to HWs, projects, etc.
 - ▶ Timely response from TAs and me
- ▶ *Logistics/admin related issues should be addressed directly to me*
- ▶ Marks: Email the TA who evaluates or me
- ▶ Reserve the right to repost answers to your questions to entire class

Grading Schema

Component	Weight	
Quizzes	30%	Two Quizzes Weight: 15% each
Programming Assignments	40%	Two Programming Assignments, Weight: 20% each, Duration: ~2-weeks
Group Project	30%	Groups of 2-3 students Duration: ~4 weeks

No Final Exam

Topics and Evaluation Schedule

Week	Date	Topics	Techniques	Tutorial	Programming Assignments (2*20%) & Group Project (30%)
1	15-Aug	Logistics and Course Overview			
2	22-Aug	Pricing	Regression (LASSO)	Stats Modules	
3	29-Aug	Targeting existing customers	Classification (SVM)	Scikit Learn	PA1 released (6:00 PM)
4	5-Sep	Targeting new customers (Market segmentation)	Clustering (K-Means, etc.)	Scikit Learn	
5	12-Sep	Recommending Products	Recommendation systems	ML Pipelines	PA1: deadline (11:59 PM) PA2: released (6:00 PM)
6	19-Sep	A/B Tests (designing products, websites or ads)	Sequential Optimization (MAB)	Related Packages	
	26-Sep		Reading Week		
7	3-Oct	Quiz – 1 (Weightage: 15%, Syllabus: Weeks – 2 to 6, Face to Face in class)			PA 2: deadline: 8th October, 11:59 PM
8	10-Oct	Customer Churn	Neural Networks	Project description	Project released: Tuesday 6:00 PM
9	17-Oct	Social Media Monitoring – I (brand recognition)	Image Analytics (CNN)	PyTorch	
10	24-Oct	Social Media Monitoring – II (opinion mining)	Text Analytics (Word Vectors)	Text Analytics	
11	31-Oct	Market structure or competitor analysis	Graph Analytics	Related packages	
12	7-Nov	Using AI models Responsibly	Explainability and Fairness in AI	Concluding Remarks	Project deadline: Tuesday 11:59 PM
13	14-Nov	Quiz – 2 (Weightage: 15%, Syllabus: Weeks – 8 to 12, Face to Face in class)			

Lectures/Tutorials

- ▶ Slides and Tutorial questions will be posted on Canvas *maximum* one day before the lecture.
 - ▶ More time as it helps us to provide you more quality slides
- ▶ Optimize your time in class!
 - ▶ Understand as much as you can during class time
 - ▶ Ask questions and stay engaged

Quizzes

- ▶ Two Quizzes: 30% ($2 \times 15\%$) of your grade
 - ▶ Designed to test your theoretical understanding of the business and technical concepts
- ▶ Format: closed book MCQs
 - ▶ Conducted during the class timings on Week – 7 and Week – 13.

Programming Assignments

- ▶ Total of two programming assignments
 - ▶ (2*20) 40% of your final grade
- ▶ Adapt to coverage during lectures/tutorials
- ▶ You will have \sim two weeks to solve these assignments
- ▶ **Start as early as possible!**

Group Project

- ▶ In groups of 3 – 4 (depending on class size)
 - ▶ CDTL: Large group sizes difficult to coordinate; high risk of slacking
- ▶ You can form your own groups
 - ▶ Don't 'sabo' your group mates
 - ▶ There will be peer reviews
- ▶ ~ 4 weeks to complete the project, 30% of the grade

Policy

- ▶ Late submissions: Assignment maybe handed in up to **2 days** late at a penalty of **10%** of the maximum grade per day
- ▶ You may discuss assignment questions with your fellow course-mates *in the abstract*; you must write/code all final answers on your own
 - ▶ **Ensure that you understand your answers**
- ▶ You are expected to maintain the utmost academic integrity in the course
 - ▶ **DO NOT CHEAT!**
 - ▶ “... any student found guilty of plagiarism and/ or cheating in tests/ exams/ graded assignments will receive an *F grade* for the entire module. ”

Source Materials

- ▶ Mandatory: Lectures & Tutorials

- ▶ No single text book. Lectures/Tutorials based on these and other online references. Pointers to specific sections/websites given in slides/tutorials.

- ▶ References:

- ▶ Business Intelligence, Analytics and Data Science: A Managerial Perspective (4th Ed.), by Ramesh Sharda, Dursun Delen, Efraim Turban
 - ▶ Business Intelligence Guidebook: From Data Integration to Analytics, by Rick Sherman
 - ▶ Data Science From Scratch: First Principles with Python, by Joel Grus
 - ▶ Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications, by Laura Igual, Santi Segui
 - ▶ An Introduction to Statistical Learning, by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani
 - ▶ Data Mining: Concepts & Techniques, by Jiawei Han, Micheline Kamber, Jian Pei
 - ▶ Operations Research: Applications and Algorithms, by Wayne Winston, Jeffrey Goldberg
 - ▶ Hands-On Machine Learning with Scikit-Learn & TensorFlow, by Aurelien Geron
 - ▶ Python for Data Analysis: Data Wrangling with Pandas, Numpy, and IPython, by Wes McKinney

Thank You
