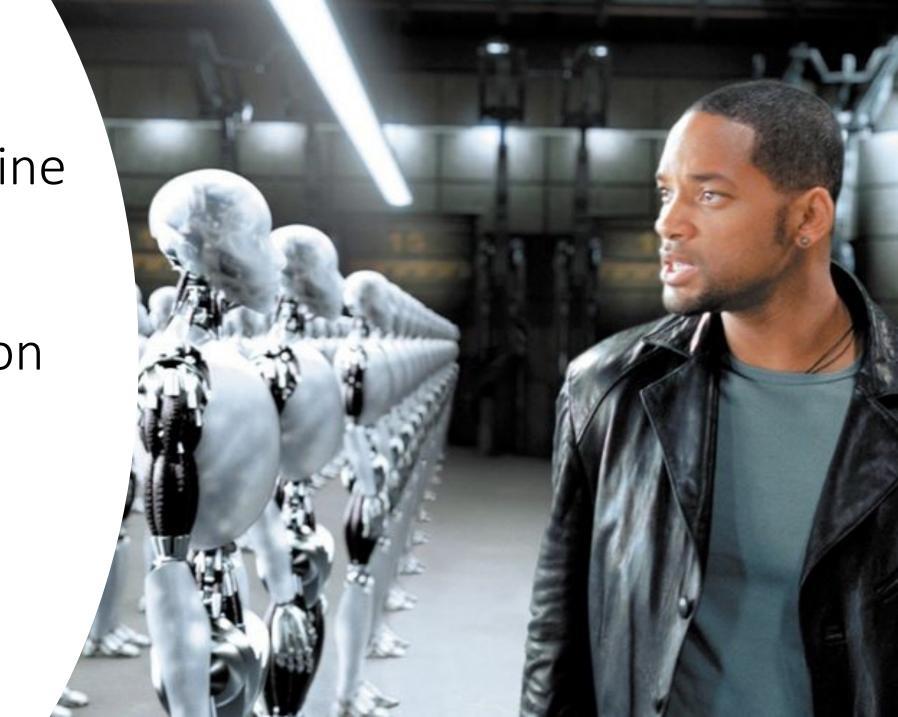
ECE 5400 Applied Machine Learning

L1: Introduction to AI/ML

Prof. Xun Jiao



#### Outline

Background Survey

Course Logistics

Introduction to AI/ML



Xun Jiao

Personal webpage: <a href="http://www.ece.villanova.edu/~xjiao/">http://www.ece.villanova.edu/~xjiao/</a>

DETAIL Group webpage: <a href="https://vu-detail.github.io/">https://vu-detail.github.io/</a>

Assistant Professor of ECE@VU

• Department of Electrical and Computer Engineering

Director of DETAIL Lab@VU

 Dependable, Efficient, and Intelligent Computing Lab (DETAIL)

I teach courses

• C Programming, embedded system, computer architecture, machine learning, and microcontroller application

I do research

• Machine learning (AI), and embedded system

I work with students

• Ph.D. + MS + undergrad

## A few examples of AI/ML Applications/Research

https://vu-detail.github.io/publication



See More

\$

#### **Brannon Rains**

To: Hasshi, Xun Cc: Tim & 3 more...

Details

ils

Professor Sudler, Dr. Jiao, and William Thank you again for taking the time to speak to our personal offices on your important work, providing background information on the many applications of blockchain technology, including contract tracing, and speaking to the importance of U.S. leadership in this field. We think the conversation went really well and have received a lot of good feedback from both sides of the isle on your experience and insights into blockchains.

We would greatly appreciate the opportunity to learn more about your work as it continues to develop.

Best, Brannon

Hello Brannon,









#### ECE Faculty Lead Blockchain Project to Track Electronic Medical Records in Response to COVID-19



Hasshi Sudler '92 EE



Dr. Xun Jiao

Hasshi Sudler '92 EE, an adjunct faculty member in Electrical and Computer Engineering, is a leading voice on the topic of blockchain. Currently, he is spearheading an effort to track electronic medical records over a blockchain to help stem the spread of the COVID-19 virus. "The blockchain can be a common source of data that allows medical facilities to share immutable information internationally," he explains. His work on this project has attracted the attention of numerous sources, including

MoveYourMoney.org. Coindesk.com and Cryptonewsz.com, and that attention

Along with Assistant Professor Dr. Xun Jiao, Sudler presented the background and use cases of a blockchain solution for contact tracing. Villanova was one of three panelists on the conference call, which included Toyota on 3-D printing face shields for hospitals, and Jacksonville Transportation Authority on the use of autonomous vehicles to transport COVID-19 test kits.

recently resulted in a presentation to the US House Energy and Commerce committee.

Brannon Rains, a policy analyst at the House of Representatives, responded to Dr. Jiao and Sudler's presentation, writing, "We have received a lot of good feedback from both sides of the aisle on your experience and insights into blockchains. We would greatly appreciate the opportunity to learn more about your work as it continues to develop."

Sudler notes one significant development in particular: The Villanova University COVID-19 blockchain team has partnered with R3, an enterprise software firm that works with a broad ecosystem to develop on Corda, its open-source blockchain platform, and Corda Enterprise, a commercial version of Corda for enterprise usage. Corda enables businesses to transact directly and in strict privacy using smart contracts. Sudler says, "This partnership provides Villanova with access to the company's enterprise version of the application and invaluable technical expertise and experience for building specific features on Corda to improve COVID-19 contact tracing."

Given Sudler's expertise and passion for the project, we can expect to see further coverage of his work in a variety of outlets.

#### Q News Archives

- 2019
- 2018
- 2017
- 2016
- 2015



Campus Calendar



- · Art of Engineering Exhibit
- . Dean's Awards Dinner
- Engineering Alumni Society
   Awards Reception
- Engineering Convocation
- · Engineers Week
- The Cunningham/Ward Lecture Series in Engineering

Nonlinear Dyn https://doi.org/10.1007/s11071-020-05815-z



#### ORIGINAL PAPER

#### Nonlinear dynamic analysis of an epidemiological model for COVID-19 including public behavior and government action

C. A. K. Kwuimy · Foad Nazari · Xun Jiao · Pejman Rohani · C. Nataraj @

Received: 12 May 2020 / Accepted: 8 July 2020 © Springer Nature B.V. 2020

Abstract This paper is concerned with nonlinear modeling and analysis of the COVID-19 pandemic currently ravaging the planet. There are two objectives: to arrive at an appropriate model that captures the collected data faithfully and to use that as a basis to explore the nonlinear behavior. We use a nonlinear susceptible, exposed, infectious and removed transmission model with added behavioral and government policy dynamics. We develop a genetic algorithm technique to identify key model parameters employing COVID-19 data from South Korea. Stability, bifurcations and dynamic behavior are analyzed. Parametric analysis reveals conditions for sustained epidemic equilibria to occur. This work points to the value of

nonlinear dynamic analysis in pandemic modeling and demonstrates the dramatic influence of social and government behavior on disease dynamics.

**Keywords** SEIR model · Epidemiology · COVID-19 · Nonlinear dynamics

#### 1 Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2) that was first identified in China in early December 2019. It has



#### Outline

- Background Survey: <u>https://docs.google.com/forms/d/e/1FAIpQLSd7SsSkHXPxvuny6TXQz</u> RCqWDQLVa7z27LwBgey5pd8H4Jfnw/viewform?usp=sf\_link
- Course Logistics
- Introduction to machine learning
- Overview of the course

## Course Logistics

#### Office Hour

- Office Location: Tolentine Hall Rm 415
- Office Hour: Monday 1pm-3pm or by appointment; most problems can be resolved by emails or just come to my office to talk.

### Grading

• Assignment (mix of HW, mini projects, paper reading, etc): 40%

• Midterm: 30%

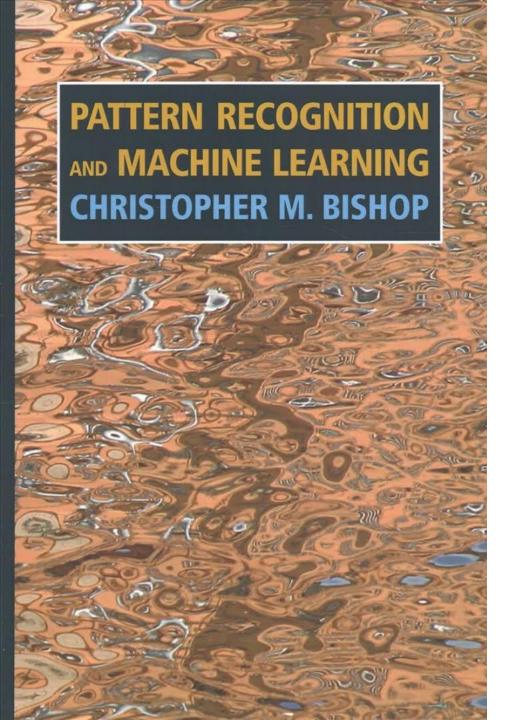
• Final: 30%

• Late submissions will be assessed a 10% penalty per day.

Letter Grade	Numerical Grade	Letter Grade	Numerical Grade
Α	94 to 100	С	73 to 76
A-	90 to 93	C-	70 to 72
B+	87 to 89	D+	67 to 69
В	83 to 86	D	63 to 66
B-	80 to 82	D-	60 to 62
C+	77 to 79	F	Less than 60

#### Attendance

- Where possible, students should inform their instructors if they plan to be late or absent from class. In all cases, students should be prepared to provide documentation to petition for excused absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. Students should use the form for requesting an excused absence. Excused absences do not count toward a failure in the course for first year students. Absence from class does not release the student from work assigned. Students who miss an inclass obligation (exam, presentation, etc.) due to an excused absence will not be penalized the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement.
- The University's list of excused absences for all students includes the following:
  - participation in NCAA athletic competitions
  - participation in special academic events (e.g., conferences, field trips, project competitions)
  - participation in official university business (e.g., student representatives attending meetings related to university governance)
  - attendance at significant events involving the immediate family (e.g., funerals, weddings)
  - religious holidays see the University's policy on Religious Holidays
  - college-approved participation in placement activities (e.g., job interviews, graduate school interviews, attending job fairs)
  - documented serious illness or disability



#### **Course Materials**

- Recommended but not required:
  - Pattern Recognition and Machine Learning (Bishop)

#### **Academic Integrity**

- The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs.
- Students are encouraged to read the University's academic integrity policy.
- The College of Engineering has adopted the following exam guidelines:
  - Students must arrive before the start of the exam. Under exceptional circumstances a student may need to arrive late, but he/she can enter the exam no later than 5 minutes after the start of the exam.
  - All cell phones must be turned off and stored away until the student exits the exam room.
  - The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an exam.
  - Each student must <u>write and sign</u> the following statement, "I have neither given nor received any unauthorized assistance in the completion of this exam."

#### Students with Disabilities

- It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability, please contact me after class or during office hours to make arrangements.
- If you have a non-physical disability you need to register with the Learning Support Office by contacting 610-519-5176 or at <a href="mailto:learning.support.services@villanova.edu">learning.support.services@villanova.edu</a> as soon as possible. Registration is needed to receive accommodations.
- The Office of Disability Services collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical disabilities the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities @ 610-519-3209 or visit the office on the second floor of the Connelly Center.



## What is Learning?

• "Learning is any process by which a system improves performance from experience." - Herbert Simon

# What is Machine Learning?

## Kevin P. Murphy (Author of the textbook *Machine Learning: A Probabilistic Perspective*):

 "a set of methods that can automatically detect patterns in data, and then use the uncovered patterns to predict future data"

## Tom Mitchell (Author of the textbook *Machine Learning*)

 Machine Learning is the study of computer algorithms that improve automatically through experience. Applications range from data mining programs that discover general rules in large data sets, to information filtering systems that automatically learn users' interests.