

USC Viterbi

CSCI 499: AI for Social Good (undergraduate)

Units: 4

Spring 2019 – Tuesday/Thursday – 1:00-2:50

Location: SAL 213

D-Clearance Request: <https://goo.gl/forms/SYeKcUgoxHXAsr6D3>

Instructors: Bistra Dilkina

Office: SAL 304

Office Hours: TBD(General guideline: 1 weekly office hour for each 4 unit class taught. Office hours are not to be calculated in “contact hours.”)

Contact Info: dilkina@usc.edu

Course Description

The course will focus on understanding how AI can be leveraged for social good. It will introduce AI concepts such as data mining, machine learning, decision making and optimization, influence maximization in networks, and game theory in the context of informing applications in environmental sustainability (biodiversity, climate, water, forests), disasters and climate change, agriculture, poverty, homelessness, and health.

Learning Objectives

1. Gain familiarity with diverse set of AI techniques
2. Learn about pressing social good problems and the underlying computational challenges that can inform them
3. Become familiar with successful applications of AI techniques to real-world social good problems

Prerequisite(s): No formal prerequisites, but exposure to machine learning, AI, and/or algorithms is strongly recommended.

Co-Requisite (s): course(s) that must be taken prior to or simultaneously

Concurrent Enrollment: course(s) that must be taken simultaneously

Recommended Preparation: course work or background that is advisable, not mandatory

Course Notes

Letter grade. Readings and slides will be posted to blackboard.

Description and Assessment of Assignments

1. **Reviews:** The course will explore the course topics through a series of assigned readings in the form of papers (and book chapters). Students will be expected to read the papers before class and submit a one page review for 2 of the assigned reading papers as homework. Students will get credit for every review submitted. Reviews are expected to be turned in at the beginning of the. Every review should address the following 5 questions:

1. What is the main problem/task addressed by the paper?
2. What was done before, and how does this paper improve on it?
3. What is the one cool technique/idea/finding that was learned from this paper?
4. What part of the paper was difficult to understand?
5. What generalization or extension of the paper could be done?

2. **Presentation:** Students will present a social good application of interest and how AI was used to help inform or solve it (assigning recommended reading to the class as background).

3. **Project/Survey Paper:** A key component of the course will be choosing to do either a survey paper or a hands on project. Students will be expected to prepare survey/project proposals halfway through the course, and give presentations of their projects/papers at the end of the course. The final project paper should have the structure of a conference paper with problem statement, lit review, approach, empirical results and discussion. A statement of author contributions (i.e. who did what) must be turned in with the final draft. Rough drafts and partial drafts will be due at different points

throughout the semester so that the instructor may provide students with constructive input along the way.

Draft Outline:

Week 1: Introduction

Week 2: Data mining /clustering (climate)

Week 3: ML (energy, wildlife poaching, agriculture)

Week 4+5: Deep Learning (Poverty, Land cover, Camera Trap Animal Images)

Week 6: Network Diffusion and Submodular Optimization (spread of information among homeless youth, water network contamination, citizen science)

Week 7+8: Optimization, Integer Programming (wildlife conservation)

Week 9: Stochastic Optimization (wildlife conservation, crop yield)

Week 10+11: Reinforcement Learning (wildfire, etc.)

Week 12: Game Theory (green security games: forests, poaching, etc)

Week 13: AI & Fairness

Week 14: AI & Fairness

Week 15: Project Presentations

Ideas for project datasets:

Google Earth Engine

https://earthengine.google.com/case_studies/

Hack for change

<http://hackforchange.org/challenges/citysdk/>

Food Open Data Challenge

<http://www.nesta.org.uk/food-open-data-challenge>

USDA Innovation Challenge for Food Resilience

<http://usdaapps.devpost.com/>

USDA Food Access Research Atlas

<http://www.ers.usda.gov/data/fooddesert>

Food Dessert - tutorial data science

<http://blog.datascience.com/datascience-workshop-geographic-data-analysis-of-los-angeles/>

Open Data Challenge Series UK

<http://www.nesta.org.uk/open-data-challenge-series>

American Energy Data Challenge

<http://energychallenge.energy.gov/>

Esri Health and Climate Challenge

<http://www.esri.com/landing-pages/industries/health/climate-change-app-challenge>

Data Science for Social Good Chicago

<http://dssg.uchicago.edu/projects/>

[Dataset] Climate and Food Security

How well can we predict crop yields as a function of weather and climate? The first link below provides data generated by a detailed crop simulator (courtesy of David Lobell) that you can use as a starting point. Successful models can then be tested on real world data from satellites. Accurate models could be used to improve our understanding of poverty and hunger in

developing countries as well as to better inform farming practices (precision agriculture). The second link proposes an alternative approach for predicting aggregate yields at the county or national level using different data sources.

[Link](#)

[Link](#)

[Dataset | Poverty mitigation]

Eradicating worldwide poverty by 2030 is the top goal on the United Nations' sustainable development agenda, published late last year. But a lack of data has frustrated efforts to measure progress toward the goal. Is it possible to accurately predict economic indicators such as expenditures and asset-based measures of wealth from high resolution satellite images? Data set provided by Neal Jean.

[Link](#)

[Dataset | Challenge in Conservation]

Large Landscape Conservation - Synthetic and Real-World Datasets Bistra Dilkina, Katherine Lai, Ronan Le Bras, Yexiang Xue, Carla P. Gomes, Ashish Sabharwal, Jordan Suter, Kevin S. McKelvey, Michael K. Schwartz and Claire Montgomery. AAAI-13: AAAI Conference on Artificial Intelligence

[Link1](#)

[Link 2](#)

[Dataset | Challenge in Conservation | POMDP]

Adaptive management of migratory birds under sea level rise. Nicol S, Iwamura T, Buffet O, Chadès I. International Joint Conference on Artificial Intelligence (IJCAI)

[Link](#)

[Dataset | Challenge in Climate]

Forecast Oriented Classification of Spatio-Temporal Extreme Events. Z. Chen, Y. Xie, Y. Cheng, K. Zhang, A. Agrawal, W. Liao, N. F. Samatova, and A. Choudhary. International Joint Conference on Artificial Intelligence (IJCAI)

[Link](#)

[Home Energy]

REDD: A public data set for energy disaggregation research. Zico Kolter and Matthew J. Johnson. SustKDD: Workshop on Data Mining Applications in Sustainability

[Link](#)

Smart*: An Open Data Set and Tools for Enabling Research in Sustainable Homes. Sean Barker, Aditya Mishra, David Irwin, Emmanuel Cecchet, Prashant Shenoy, and Jeannie Albrecht. SustKDD: Workshop on Data Mining Applications in Sustainability, 2012.

[Link](#)

[Smart cities | Bike Share]

Balancing bike sharing systems (BBSS): instance generation from the CitiBike NYC data. arXiv preprint arXiv:1312.3971 Urli, Tommaso.

[Link](#)

Grading Breakdown

	Weight
Class participation	5%
Paper Reviews	10%
Class Presentation	25%
Final Project/Survey	60%
Proposal (5%)	
Preliminary Draft (10%)	
Final Presentation (10%)	
Project/Final Paper (35%)	

Assignment Submission Policy

Paper reviews and other deliverables should be submitted before the start of class on the due date on blackboard (unless otherwise instructed).

Additional Policies

Add any additional policies that students should be aware of: late assignments, missed classes, attendance expectations, use of technology in the classroom, etc.

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

Note on Collaborative Work

For collaborative projects, students are expected to have equal distribution. If there is any perceived imbalance in the collaborative project, the student should bring this to the attention of the instructor or the teaching assistant.

Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should

check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicssupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.