



**USC**

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**CSCI-499: Artificial Intelligence for Sustainable Development**

**Units: 4**

**Fall 2020 MW 2:00-3:50pm**

**Instructors:** Bistra Dilkina

**Office:** SAL 304

**Office Hours:** 1 fixed-time office hour with instructor plus by appointment. 2 fixed-time office hours with TA.

**Contact Info:** [dilkina@usc.edu](mailto: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, and fairness in machine learning and algorithmic decision making in the context of informing applications in environmental sustainability (biodiversity, climate, water, forests), disasters and climate change, 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):**

1. CSCI-270
2. CSCI-360 or CSCI-467

**Recommended Preparation:** Python programming skills

## **Course Notes**

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

## **Required Readings and Supplementary Materials**

At this time, the growing area of AI applications in social good has not yet been formalized in a textbook. Therefore, most of the readings will be based on research papers and articles that will be provided to the class as PDF based handouts via Blackboard. The following books provide useful background information about the techniques studied in class. However, they do not discuss the application to specific social good settings.

1. Artificial Intelligence: A Modern Approach. Stuart Russell and Peter Norvig, 2010
2. Deep Learning, Goodfellow, I., Bengio, Y. and Courville A., 2016.

## **Description and Assessment of Assignments**

### *Paper reviews*

The course will explore the course topics through a series of assigned readings in the form of research papers (and book chapters). Students will be assigned 1-2 research papers to read for a given week and submit a one page review for 1-2 of the assigned reading papers as homework. There will be 8 (+ 1 optional) such paper reviews assigned through the semester. Reviews will be assessed based on answering the following 5 questions (based on clarity and correctness):

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?

### *Coding Assignments*

Students will present implement techniques studies in class by completing Python notebook assignments. The assignments will be graded based on completion and correctness.

### *Class Presentation*

Students will present individually or in small groups an AI for Social Good research paper to the class. The paper will be selected from a list of papers selected by the instructor, or outside of the selected list with instructor permission. Each presentation will be 20 mins. The presentations will be graded on clarity, completeness, and presentation style.

### *Semester Project*

Students will work in small groups to carry out a class project. The focus of the class project will be to develop an innovate application of AI to address a social good problem. Students will leverage tools, concepts, and techniques presented in the class. The project involves identifying a problem related to social good, data sources available to inform the problem, and AI-based approaches to it. Project topics will be suggested by the instructor, and also students will have the freedom to propose their own. The grade for the project will be based on the successful completion of the agreed upon project objectives. The deliverables include a project proposal (1-2 pages single space), a mid project report (4-8 pages single space), final presentation (10-20 minutes) and a final report (10-15 pages single space). They will be graded based on clarity, and completeness. The project is total 55% of final grade with the following breakdown:

Proposal (5%)
Project Mid Report (10%)
Final Presentation (10%)
Project/Final Paper (30%)

## Grading Breakdown

The grades for the students will be based on completion of the paper review assignments, presentation of a research paper, programming assignments, and a semester project. The breakdown for each of these categories is listed below. A more detailed explanation of the grading for each category is also provided.

Assessment Tool (assignments)	Points	% of Grade
Class participation	9pts	9%
Paper Reviews (8x1%)	8x3pts	8x1%=8%
Python assignment (4x2%)	4x5pts	4x2%=8%
Class Presentation	20pts	20%
Final Project	55pts	55%
<b>TOTAL</b>		100%

## Assignment Submission Policy

Assignments will be submitted via Blackboard.

## Grading Timeline

Grades will be provided within 2 weeks of submission of the respective assignment.

## Additional Policies

This is a discussion-based course, hence consistent attendance is expected. Lack of attendance will affect the class participation score. Missed classes with a valid excuse are allowed. Class participation will be scored based on engagements in course discussions.

## Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Deliverables
<b>Week 1</b>	Introduction + History of AI	
<b>Week 2</b>	Data Mining + Clustering / Climate	Paper review 1
<b>Week 3</b>	Regression (Cross-Validation, Features Selection) / Applications	<b>Python assignment 1: clustering</b>
<b>Week 4</b>	Regression / Applications	Paper review 2, <b>Python assignment 2: regression</b>
<b>Week 5</b>	Classification (Trees, Ensembles, Feature Importance) / Applications	Paper review 3, <b>Project Proposal</b>
<b>Week 6</b>	Deep Learning & Remote Sensing / Applications	Paper Review 4
<b>Week 7</b>	Student Paper Presentations	<i>Paper Presentation</i> , Optional Paper Review
<b>Week 8</b>	Student Paper Presentations	<i>Paper Presentation</i> , Paper Review 5
<b>Week 9</b>	Optimization, Integer Programming / Applications	Paper review 6, <b>Python assignment 3: optimization</b>
<b>Week 10</b>	Optimization, Submodular + Network Diffusion Models / Applications	<b>Project mid report</b>
<b>Week 11</b>	AI & Fairness	Paper review 7, <b>Python assignment 4: fairness</b>
<b>Week 12</b>	AI & Fairness	Paper review 8
<b>Week 13/14</b>	Project Presentations	<b>Project Presentations</b>
<b>FINAL</b>	Project Report	<b>Project Report</b> due on University-scheduled date of the final exam

### 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 Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

## Support Systems:

*Counseling and Mental Health - (213) 740-9355 – 24/7 on call*

[studenthealth.usc.edu/counseling](http://studenthealth.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*

[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call*

[studenthealth.usc.edu/sexual-assault](http://studenthealth.usc.edu/sexual-assault)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298*

[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

*Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298*

[usc-advocate.symplcity.com/care\\_report](http://usc-advocate.symplcity.com/care_report)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

*The Office of Disability Services and Programs - (213) 740-0776*

[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Campus Support and Intervention - (213) 821-4710*

[campussupport.usc.edu](http://campussupport.usc.edu)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.

*Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)*

[ombuds.usc.edu](http://ombuds.usc.edu)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.