USC Viterbi
School of Engineering
*Information Technology Program*

# ITP-499: Applied Artificial Intelligence

**Units:** 4
**Term: Fall 2021**
MW 10 am – 11:50 am

**Location:** TBD
**Instructor**: Nitin Kalé
**Office:** RRB 224
**Office Hours:** Timing and location posted on Blackboard
**Contact Info:** kale@usc.edu

**Teaching Assistant**: TBD
**Office:** TBD
**Office Hours:** TBD
**Contact Info:** TBD

**IT Help:** Viterbi IT
**Hours of Service:** Monday – Friday, 8:30 a.m. – 5:00 p.m.
**Contact Info:**
DRB 205
(213) 740-0517
engrhelp@usc.edu

**Catalog Description**

Learn concepts and build skills in artificial intelligence. Learn about applications of AI that are already changing society, business, transportation, manufacturing and more.

**Course Description**

Learn about the latest developments in the field of artificial intelligence. Build skills in applications of AI algorithms. Core concepts include artificial neural networks, deep learning and reinforcement learning. Learn techniques in natural language processing, machine vision, automation.

**Learning Objectives**

After completing the course students will be able to:

- Define artificial intelligence and its use cases
- Explore latest advances in artificial intelligence
- Explain the basics of specific AI techniques
- Apply those techniques to solve real world problems
- Think critically about the impact (benefits and pitfalls) of AI on the world

**Prerequisite(s):** None
**Co-Requisite(s):** None
**Concurrent Enrollment:** None
**Recommended Preparation:** Knowledge of Python and basic understanding of machine learning

**Course Notes**

Grading Type: Letter Grade.
Lecture slides, assignments, readings, announcements, and other class information will be posted on Blackboard.

**Hardware/Software Required**

Platforms, packages, and tools that will be used for the class will be provided to students free of charge. The following software will be used in the class. Students should have access to a computer (ITP can provide loaner laptops is needed)

- IBM Watson – IBM Cloud - https://cloud.ibm.com/developer/watson/dashboard
- Python packages – Keras, PyTorch, TensorFlow, scikit-learn - https://www.tensorflow.org/
- Recast.ai chatbot - https://cai.tools.sap/
- NLTK - https://www.nltk.org/

**Required Readings and Supplementary Materials**

Readings will be assigned from the following sources. All books are available online through USC Safari Books. https://libraries.usc.edu/databases/safari-books

- Getting Started with Artificial Intelligence, by Tom Markiewicz, Josh Zheng (MZ)
    - Publisher: O'Reilly Media, Inc.
    - Release Date: April 2018
    - ISBN: 9781492027799

- Getting started with TensorFlow, by Aurélien Géron (G1)

    - Publisher: O'Reilly Media, Inc.
    - Release Date: April 2017
    - ISBN: 9781491978740

- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, by Aurélien Géron (G2)
    - Publisher: O'Reilly Media, Inc.
    - Release Date: September 2019
    - ISBN: 9781492032649

- Hands-On Artificial Intelligence for Beginners, by Patrick D. Smith (SM)
    - Publisher: Packt Publishing
    - Release Date: October 2018
    - ISBN: 9781788991063

**Grading Breakdown**

| Assignment | % of grade |
|---|---|
| Homework | 40 |
| Midterm Exam | 30 |
| Final Exam | 30 |
| **TOTAL** | 100 |

**Description and Assessment of Assignments**

The Course Schedule on Page 5 describes assignment description and due dates. Assignments will be assessed on timeliness, completeness, thoroughness, and conclusions.

**Assignment Submission Policy**

Students are responsible for completing individual assignments by stated deadlines. Assignments turned in late will have 25% of the total points deducted from the graded score for each late day.

**Grading Timeline**

Assignments will typically be graded within one week of the submission deadline.

**Additional Policies**

Students are expected to attend and participate in lecture discussions and in-class exercises.

No make-up exams (except for documented medical or family emergencies) will be offered. If they will not be able to attend an exam due to an athletic game or other valid reason, then they must coordinate with the instructor before the exam is given. They may arrange to take the exam before they leave, with an approved university personnel during the time they are gone, or within the week the exam is given. If students do not take an exam, they will receive a 0 for the exam.

If students need accommodations authorized by DSP (Disability Services and Programs), notify the instructor at least two weeks before the exam. This will allow time for arrangements to be made.

Zoom synchronous sessions will be recorded (per USC guidelines for the respective semester) and provided to all students asynchronously.

**Sharing of course materials outside of the learning environment**
*SCampus Section 11.12(B)*
*Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study is a violation of the USC Student Conduct Code. This includes, but is not limited to, providing materials for distribution by services publishing class notes. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the Internet or via any other media. (See Section C.1 Class Notes Policy).*

## Course Schedule: A Weekly Breakdown

| Week | | Topics/Daily Activities | Readings (R)[1] and Homework (HW) | Due Dates |
|---|---|---|---|---|
| **1** | Lecture 1 | Introduction to AI | R: MZ- Ch1 | |
| | Lecture 2 | History of AI | | |
| **2** | Lecture 1 | Review of unsupervised learning, Clustering | HW1: Use Python scikit-learn to cluster and classify cases | |
| | Lecture 2 | Review of supervised learning Classification | | |
| **3** | Labor Day University Holiday | | | |
| | Lecture 2 | Basics of AI | | HW1 Due |
| **4** | Lecture 1 | Human intelligence, cognition, test for AI | HW2: Write code in Python to autogenerate class labels from unsupervised machine learning. | |
| | Lecture 2 | AI categories – Narrow, strong, super<br>AI Techniques - AGI, Deep learning, reinforcement learning, GAN | | |
| **5** | Lecture 1 | Transfer learning<br>Reinforcement learning | R: G1 – Ch1-3 | HW2 Due |
| | Lecture 2 | Neural Networks | | |
| **6** | Lecture 1 | Deep Learning | HW3: Use NN to train and classify images e.g. animals, people, traffic. | |
| | Lecture 2 | Deep Learning contd. | | |
| **7** | Lecture 1 | TensorFlow | R: MZ- Ch 2 | HW3 Due |
| | Lecture 2 | Keras | | |
| **8** | Lecture 1 | Natural Language Processing, text classification, sentiment recognition, information retrieval, name entity recognition, machine translation, parsing, part-of-speech tagging | HW4: Use TensorFlow to implement a basic language translator. | |

[1] Safari books are available through USC Libraries. Reading links will be posted on Blackboard.

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|---|---|---|---|---|
| | Lecture 2 | **Midterm Exam**<br>**Format**: In-class, in-person, on-device, open-book | | |
| **9** | Lecture 1 | Speech Recognition, speech to text, trigger word (Hey google) | R: G2- Ch2, Ch10 | HW4 Due |
| | Lecture 2 | Speech synthesis (text to speech)<br>Chatbots | HW5: Implement a speech to text converter. | |
| **10** | Lecture 1 | Machine Vision | | |
| | Lecture 2 | Image Classification | R: MZ – Ch4 | |
| **11** | Lecture 1 | Object recognition, face recognition, object detection | | HW5 Due |
| | Lecture 2 | Image segmentation, tracking objects in video | HW6: Build a traffic navigator for a simplified self-driving car. | |
| **12** | Lecture 1 | Autonomous transportation | | |
| | Lecture 2 | Self-driving milestones<br>Levels of autonomy | R: SM – Ch 7 | |
| **13** | Lecture 1 | Autonomous driving – Algorithms, approaches, and obstacles | | HW6 Due |
| | Lecture 2 | Knowledge graph | R: SM – Ch 8 | |
| **14** | Lecture 1 | GAN Generative Adversarial Network | | |
| | Thanksgiving<br>University Holiday | | HW7: Envision and critique the future of AI. Sources can include science fiction literature, cinema, and talks by futurists and academics. Focus should be on ethics in engineering. | |
| **15** | Lecture 1 | Future of AI<br>AI and Social impact: AI and ethics, AI in society, singularity | | |
| | Lecture 2 | Bias in AI | R: SM – Ch 12, 13 | HW7 Due |
| **Week 16 FINAL EXAM** | | **Date:** For the date and time of the final for this class, consult the USC *Schedule of Classes* at classes.usc.edu/.<br>**Format**: In-class, in-person, on-device, open-book | | |

## 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. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

**Support Systems:**

*Student Health Counseling Services - (213) 740-7711 – 24/7 on call*
engemannshc.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
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) 740-4900 – 24/7 on call*
engemannshc.usc.edu/rsvp
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) | Title IX - (213) 740-5086*
equity.usc.edu, titleix.usc.edu
Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

*Bias Assessment Response and Support - (213) 740-2421*
studentaffairs.usc.edu/bias-assessment-response-support
Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

*The Office of Disability Services and Programs - (213) 740-0776*
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 Support and Advocacy - (213) 821-4710*
studentaffairs.usc.edu/ssa
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
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, 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
Non-emergency assistance or information.

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