

# CSCI-561 Foundations of Artificial Intelligence – USC – Fall 2017 Syllabus and Schedule

Lectures: Mondays & Wednesdays 5:00pm – 6:20pm in SGM-123: Prof. Laurent Itti  
 - or - Lectures: Tuesdays: 6:40pm – 9:20pm in SGM-123: Profs. Wei-Min Shen & Sheila Tejada

Discussion sections: Profs. Wei-Min Shen & Sheila Tejada & Ning Wang

Textbook: Artificial Intelligence: A Modern Approach, 3<sup>rd</sup> Ed. (AIMA)  
 Optional Reading: Autonomous Learning from the Environment (ALFE)

M - W Dates	Tues. Dates	Topic	Reading
Aug 21	Aug 22	1. Welcome – Introduction. Why study AI? What is AI? The Turing test. Rationality. Branches of AI. Brief history of AI. Challenges for the future. What is an intelligent agent? Doing the right thing (rational action). Performance measure. Autonomy. Environment and agent design. Structure of agents. Agent types.	AIMA 1, 2 (ALFE 1)
Aug 23		2. Problem Solving & Search – Types of problems. Example problems. Basic idea behind search algorithms. Complexity. Combinatorial explosion and NP completeness. Polynomial hierarchy.	AIMA 3 (ALFE 2, 6)
Aug 28	Aug 29	3. Uninformed Search - Depth-first. Breadth-first. Uniform-cost. Depth-limited. Iterative deepening. Examples. Properties.	AIMA 3 HW1 out
Aug 30		4. Continue uninformed search.	AIMA 3
Sep 4	Sep 5	Labor day no class	
Sep 6		5. Informed search – Best-first. A* search. Heuristics. Hill climbing. Problem of local extrema. Simulated annealing.	AIMA 3, 4 (ALFE 6)
Sep 11	Sep 12	6. Continue Informed search. Genetic Algorithms.	AIMA 3, 4 (ALFE 6)
Sep 13		7. Game Playing - The minimax algorithm. Resource limitations. Alpha-beta pruning. Chance and non-deterministic games.	AIMA 5
Sep 18	Sep 19	8. Constraint satisfaction. Node, arc, path, and k-consistency. Backtracking search. Local search using min-conflicts.	AIMA 6
Sep 20		9. Agents that reason logically 1 – Knowledge -based agents. Logic and representation. Propositional (boolean) logic.	AIMA 7 (ALFE 3) HW1 due
Sep 25	Sep 26	10. Agents that reason logically 2 – Inference in propositional logic. Syntax. Semantics. Examples.	AIMA 7 HW2 out
Sep 27		11. First-order logic 1 – Syntax. Semantics. Atomic sentences. Complex sentences. Quantifiers. Examples. FOL knowledge base. Situation calculus.	AIMA 8
Oct 2	Oct 3	12. First-order logic 2 – Describing actions. Planning. Action sequences.	AIMA 8
Oct 4		13. Building a knowledge base – Knowledge bases. Vocabulary and rules. Ontologies. Organizing knowledge.	AIMA 12
Oct 9	Oct 10	14. Inference in first-order logic – Proofs. Unification. Generalized modus ponens. Forward and backward chaining.	AIMA 9
Oct 11		15. Continue Inference in first-order logic. Resolution. Proof by contradiction.	AIMA 9
Oct 16	Oct 17	16. Logical reasoning systems – Indexing, retrieval and unification. The Prolog language. Theorem provers. Frame systems and semantic networks.	AIMA 9 HW2 due

Oct 18		17. Planning – Definition and goals. Basic representations for planning. Situation space and plan space. Examples.	AIMA 10 (ALFE 6) HW3 out
Oct 23	Oct 24	18. Fuzzy logic – concepts, fuzzy inference, aggregation, defuzzification.	Handout
Oct 25		19. Learning from examples – supervised learning, learning decision trees, support vector machines.	AIMA 18 + handout (ALFE 4)
Oct 30	Oct 31	20. Learning with neural networks – perceptrons, Hopfield networks. How to size a network? What can neural networks achieve?	Handout + AIMA 18
Nov 1		21. Advanced concepts in neural networks – convnets, deep learning, stochastic gradient descent, dropout learning, autoencoders, applications and state of the art	Handout
Nov 6	Nov 7	22. Reasoning under uncertainty – probabilities, conditional independence, Markov blanket, Bayes nets.	AIMA 13, 14
Nov 8		23. Continue Reasoning under uncertainty – Probabilistic inference, enumeration, variable elimination, approximate inference by stochastic simulation, Markov chain Monte Carlo, Gibbs sampling.	AIMA 14, 15 (ALFE 5)
Nov 13	Nov 14	24. Probabilistic decision making – utility theory, decision networks, value iteration, policy iteration, Markov decision processes (MDP), partially observable MDP (POMDP).	AIMA 16, 17 (ALFE 5)
Nov 15		25. Probabilistic Reasoning over time: Temporal models, Hidden Markov Models, Kalman filters, Dynamic Bayesian Networks, Automata theory	AIMA15
Nov 20	Nov 21	26. Probability-Based Learning: Probabilistic Models, Naïve Bayes Models, EM algorithm, Reinforcement Learning.	AIMA 20-21 (ALFE 5.10, 6.1) HW3 due
Nov 22		Thanksgiving – no class	
Nov 27	Nov 28	27. Natural language processing – language models, information retrieval, syntactic analysis, machine translation, speech recognition.	AIMA 22, 23
Nov 29		28. Towards intelligent machines – The challenge of robots: with what we have learned, what hard problems remain to be solved? Different types of robots. Tasks that robots are for. Parts of robots. Architectures.	AIMA 24, 26, 27 (ALFE 13)

**Midterm 1:** Monday, September 25, 2017, 8:00pm – 9:50pm, Room TBA

**Midterm 2:** Monday, October 30, 2017, 8:00pm – 9:50pm, Room TBA

**Final exam:** Friday, December 8, 2017 8:00am – 10:00am, Room TBA

**Grades:** 20% for midterm 1, 20% for midterm 2, 30% for final, 10% for each of the 3 homeworks. Some of the exam questions will be on topics covered in the discussions sessions only and not in the main lectures.

**Homeworks:** These are programming assignments, you will program some A.I. agents for search, game playing, logic inference (subject to change) from scratch. Good programming knowledge is necessary. We will use vocareum.com where you can edit, compile, and test your code in the cloud. Supported languages include C, C++, C++11, Java, and Python.

**Tentative homework topics (subject to change):**

HW1 search

HW2 game playing or constraint satisfaction problems

HW3 logic inference or neural networks

**Grading is absolute and according to the following scale:** 90 or more: A+; 80 or more: A; 75 or more: A-; 70 or more: B+; 60 or more: B; 55 or more: B-; 50 or more: C+; 40 or more: C; 35 or more: C-; less than 35: F.