**OPTIMIZATION AND LP**

Graph constraints (must be linear), find commonalities, max or min the objective function

**SEARCH**

For search you need states, actions, transition model (action effects), and costs

**Basic:**

DFS or Breath-first, Best-first, and weighted as (Uniform Cost Search) Djikstra’s

**A\*:**

Uses a heuristic to perform an informed search

Best-first with f(n) = g(n) + h(n), g(n) is the sum of costs to get to n, h(n) is the estimate of the cost to the goal

H(n) must always underestimate or match the actual distance, and it must be monotonic.

Can perform adaptive A\* by updating h values from previous searches

**Adversarial:**

Other agents involved creating a dynamic environment, see Games

**Hill climbing:**

Basic maximization greedy algo, can add random restarts or moves to guarantee a solution

**Simulated annealing:**

Use a temperature function that cools over time, allows big moves in the beginning

**Constraint satisfaction problems (CSP), backtracking:**

for problems where any solution is needed, CSP doesn’t optimize but can handle linear constraints

Map coloring problem, can use various types of consistency, node, arc, path, or multiple

Can also use heuristic approach in choosing the next variable like MRV, least-constraining, degree

Backtracking search tree dfs, can be with forward checking, or use local search algo Min-conflicts

**GAMES**

Zero-sum games vs non, balanced loss-gain vs independent loss-gain, prisoners dilemma

**Min-max:**

Build out a tree usingMinimax tree algo, has to build the full tree

Alpha-beta pruning does the same but it prunes branches that would be ruled out by a previous choice

**PROBALISTIC REASONING**

Reasoning with uncertain models, observations, actions and knowledge, conditional probability P(a|b) = p(a^b) / p(b)

Bayes rule P(a|b) = p(b|a)\*p(a) / p(b) it relates conditional probabilities and lets us figure out one with the other

**Bayesian networks, Naïve Bayes classifier:**

Bayesian network is directed acyclic graph of conditional dependence, each node is conditionally independent of its non-descendents.

Naïve bayes doesMax**(** P(res|data = p(data|res)\*p(res) / p(data) and P(not res|data) = p(data|not res)\*p(not res) / p(data) )

p(data|res) = p(data(0)|res) \* p(data(1)|res) \* …. for each feature in the data

**Kalman filter and belief space:**

Kalman filter and belief space, estimation technique in high error spaces

**Reinforcement learning:**

Reward and punishment based learning, agent interacts with environment providing numeric reward/punishment, maximize rewards

**Markov decision process:**

Markov decision process can be observable or partially observable, agent selects it actions according to a policy

Find the optimal policy and update the existing policy

**MACHINE LEARNING**

**Cross validation and Bias and Variance tradeoff:**

Cross validation, compare different machine learning methods, define a set of train and test data and run on each, k-fold CV

Bias and Variance tradeoff, bias is the inability to properly fit the training, variance is the inability to properly fit the testing

**Supervised vs unsupervised learning:**

ground truth for supervised, figure out a function to model the data

unknown truth for unsupervised, infer information about the data based on its qualities

**Decision trees, Support Vector Machine, Clustering, Linear classifiers:**

Decision trees, supervised for classification and regression, generates outcome/decisions nodes, attribute value test to split source set

SVM, generates or distinguishes two classes of data this classifier is effective in high dimensional spaces that aren’t linearly separable

k-nearest neighbors, supervised based on known classifications of other points

k-means, unsupervised for unlabeled data clustering

perceptron, supervised, also be used for linear regression, find/ adjust linear weights based on training data set, linearly separable only

**Neural networks, deep learning:**

NN made up of neuron layers, input – hidden – output layers

Layered perceptrons, feedforward ANN