HYPER-PARAMETERS FOR AWS DEEPRACER TRAINING

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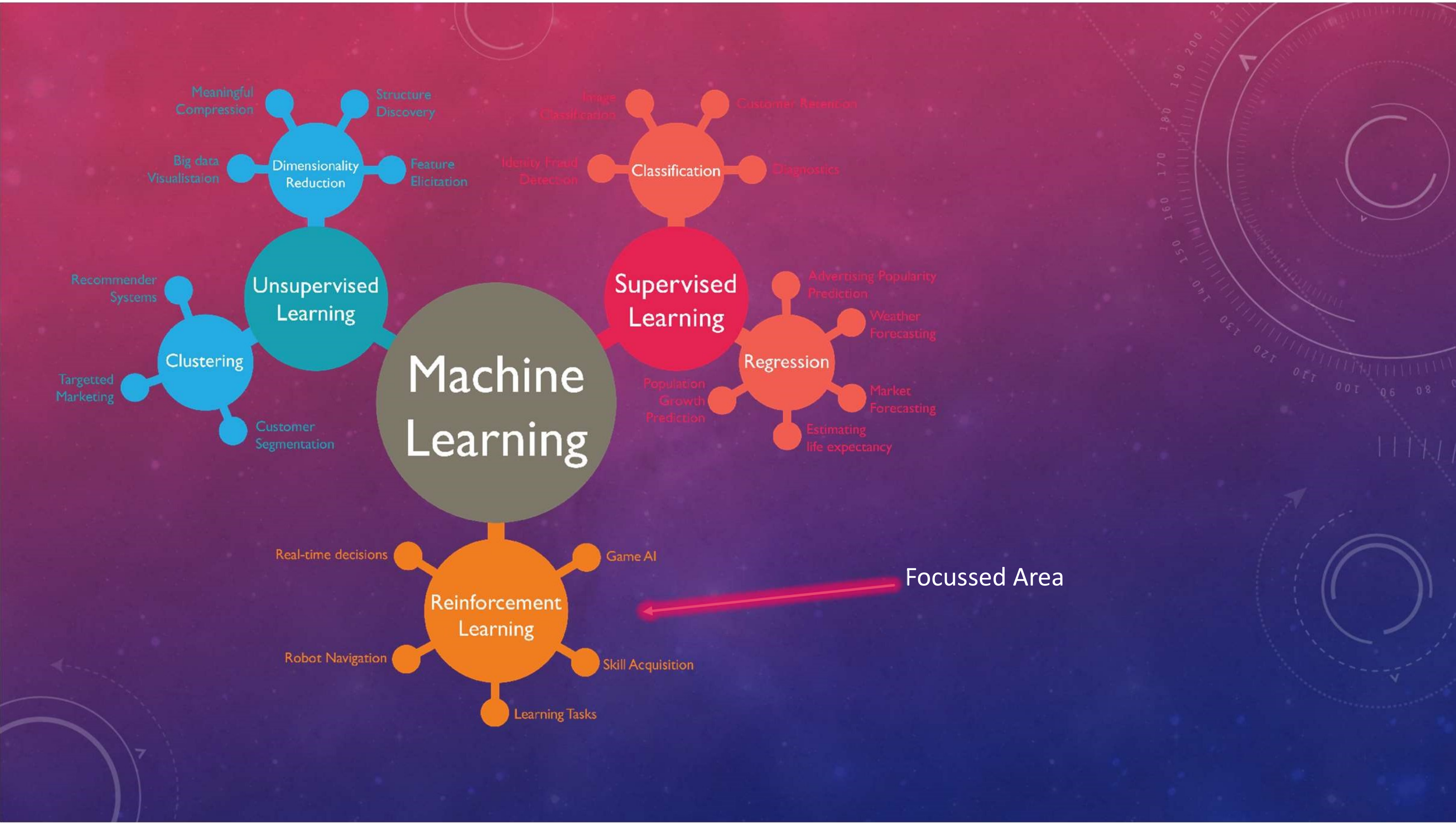
GUIDED BY DR JIAN LI

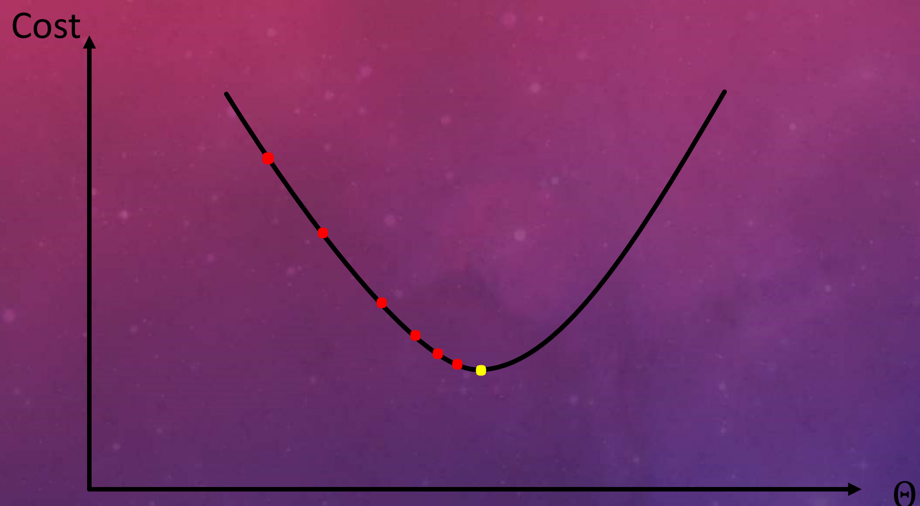


Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Market Forecasting
Estimating life expectancy
Population Growth Prediction
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks
Focussed Area

LIST OF HYPERPARAMETERS

- Gradient Descent Batch Size
- Number of Epochs
- Learning Rate
- Entropy
- Discount Factor
- Loss Type
- Number of Episodes between each Update

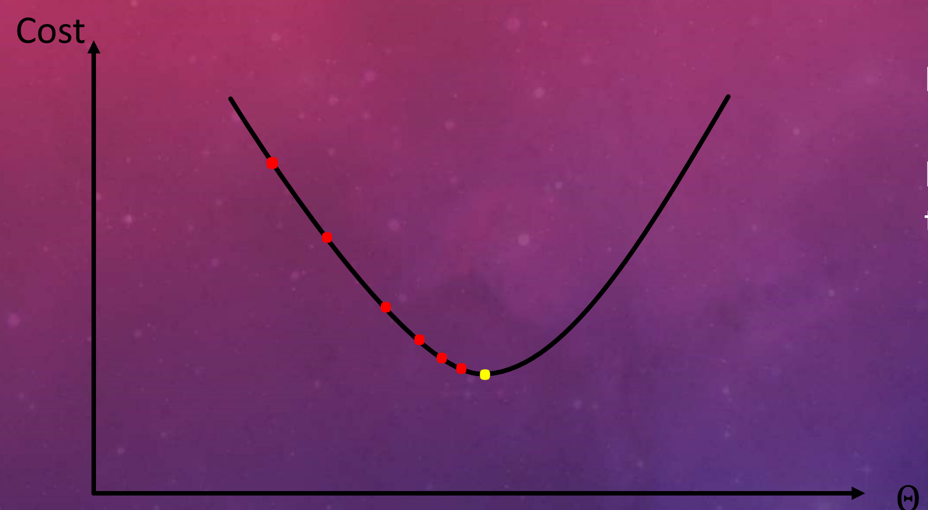
GRADIENT DESCENT PROCESS



We have a relationship between cost function and initial random vector θ . (for a linear regression model)

Our goal is to find the minimum cost for a given function. Gradient Descent is descent way to find global minimum for the given curve in the adjacent figure.

GRADIENT DESCENT PROCESS



Batch Size:

It is a number of data-points to be considered before the internal parameters change in the system.

NUMBER OF EPOCHS

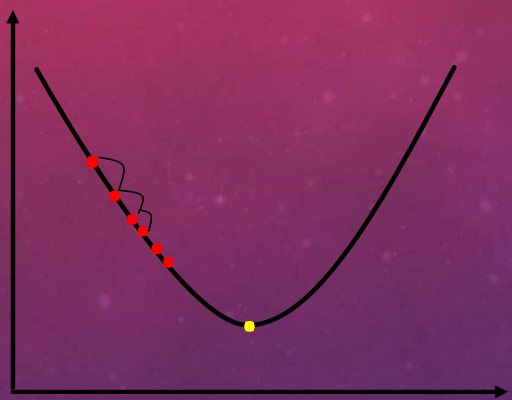
- One process from start to end is considered to be an epoch.
- In more simple term, if numbers of epoch is set to n, then the model will train n times, every time differently in more accurate manner.

LEARNING RATE

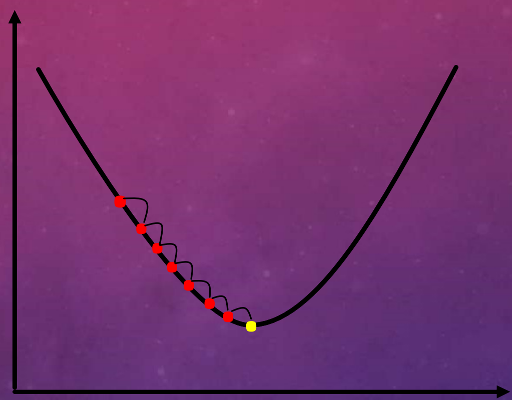
$$w(next) = w(present) + \eta * error * input$$

$$\eta \rightarrow learning\ rate$$

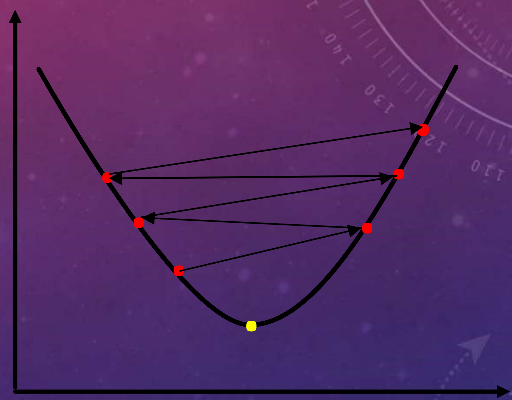
EFFECTS OF LEARNING RATE



η *too low*



η *just ideal*



η *too high*

ENTROPY

- As the name suggests, entropy is the degree of uncertainty.
- In AWS environment this parameter helps the model to explore more randomness in the action space.
- Higher value of entropy means your model can sustain more randomness.

DISCOUNT FACTOR

- Discount factor is an important parameter for Reinforcement Learning.
- Higher the discount factor, more model will look for future rewards. Lower the discount factors, model is more likely to focus on current rewards.

LOSS TYPE

- In AWS DeepRacer Environment, we are introduced with two types of losses:
  - Huber Loss
  - Mean Square Error loss (i.e. MSE)

HUBER LOSS V/S MSE

- MSE is widely known loss function. But with simplicity, robustness is a huge trade-off.
- Robustness is being considered while dealing with outliers. The AWS training environment is pre-designed. However, outliers can never be overseen.
- Different types of outliers can be explained thoroughly. Here we are being cautious about influential outliers.
- Huber loss function is more robust toward these outliers. It deals with residual in two steps.

HUBER LOSS V/S MSE

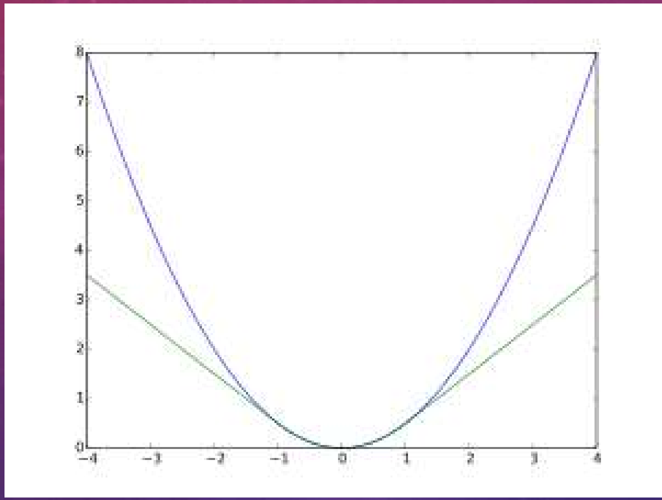
$$MSE = \frac{1}{n} \sum \epsilon^2$$

$$H(\epsilon) = \begin{cases} \frac{\epsilon^2}{2}, when\ |\epsilon| \leq k \\ k|\epsilon| - \frac{\epsilon^2}{2}, otherwise \end{cases}$$

Here, $\epsilon \rightarrow residual$

$k = 1.345 * \sigma$

HUBER LOSS V/S MSE



NUMBER OF EXPERIENCED EPISODES BETWEEN EACH POLICY UPDATE

- From the start line to the moment when agent is either off-track or finishes the lap, is considered to be one experienced episode. This episode records the actions at different data points from the environment via mounted input device.
- In Reinforcement Learning, a policy defines the learning agent's way of behaving at a given time.
- We are not designing policy for the agent. Hence, we can say that it is been taken care by internal neural network.
- By updating the policy, agent learns to behave accurately in the environment.

REFERENCES

- AWS DeepRacer Documentation: https://docs.aws.amazon.com/deepracer/latest/developerguide/awsracerdg.pdf
- Geron, A. (2019). *Hands-on Machine Learning with Scikt-Learn, Keras & Tensorflow.* O'Reilly Media, Inc.
- Sutton, R., & Barto, A. (2018). *Reinforcement Learning: An Introduction,* MIT Press.

THANK YOU!

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