Module 3

Tools in AI Development

▼ What are some cluster-based AI solutions for managing large datasets?

- Hadoop

- Spark

- multi-agent systems

▼ Tensorflow

- developed by Google

- an open source ecosystem of tools, libraries, and community resources

- As of March 2020, Tensorflow is used by 15,000+ companies including DeepMind, Apple, and Uber

- Tensorflow Lite allows simple deployment on almost any device, including ARM devices

- has an advantage in hardware utilization: using GPUs, CPUs and TPUs (Tensor Processing Units, specialized ASIC chips to accelerate AI apps), and new forms of neuromorphic chips

- Since Tensorflow version 2.0, Keras can be used inside Tensorflow directly

- like PyTorch, both frameworks operate on tensors and view any model as a directed acyclic graph (DAG)

- you describe a graph statically before a model can run

- allows you to manually fine-tune every operation to run on a specific device, enabling unlimited manual parallelism

- has a clear advantage for deployment of inference

- important to consider what type of compute device you will use for training: your CPU or GPU?

▼ Keras

- an open-source ANN library supported by Tensorflow's core library since 2017

▼ PyTorch

- developed by Meta

- used by Twitter

- a major Tensorflow competitor

- more beginner-friendly than Tensorflow and known for being quick, simple and effective

- is Torch library's Python counterpart written in Lua

- more transparent modeling process than Tensorflow

- uses a "define-by-run" mode by default

- you can define, change and execute nodes without special session interfaces or placeholders

  - this makes debugging easier because you can use Python debugging tools like pdb or PyCharm debugger or Print() statements

- has declarative data parallelism (models can be easily parallelized over batch dimension)

▼ Apache's mxNet

a framework used by AWS, Microsoft and Intel for tasks like speech and handwriting recognition, NLP and forecasting

▼ Deeplearning4j

an open-source DL framework developed by Eclipse written primarily for Java and Java Virtual machine (JVM)

▼ Use of R for ML?

- for use in statistical analysis and machine learning

- it is graphically based and is preferred by statisticians and for work in bioengineering, bioinformatics, and biomedical statistics

- it is well suited to machine learning tasks such as regression, classification, and decision tree formation.

▼ Scala for ML

- Scala is a core language of Apache Spark

- is being utilized in deploying machine learning solutions in the world of big data

▼ Apache Spark

- a comprehensive data platform that provides functionalities for big data processing and machine learning analysis through its MLLIB library

▼ Lisp, Prolog, and Haskell for GOFAI (Good Old Fashioned AI)

- Lisp, Prolog, and Haskell are all logic-based languages that are well-suited for symbolic programming.

- They are common go-tos for development of GOFAI (Good Old Fashioned AI) systems that utilize symbol manipulation.

▼ An ANN in Python will typically have what components?

- an input layer

  - takes input data as a matrix and passes it on after multiplying the input by a set of weights

  - these input parameters are often initialized randomly, or sometimes restored from a previous network checkpoint

- an activation function

  - is nonlinear

  - determines if a neuron has been activated

  - examples: ReLU, Tanh, and sigmoid (easy for beginners)

- feedforward propagation

- your code will iterate through the matrices given as input data

- in each iteration, you will loop over the input data as a certain number of times, calculating the derivative (the rate of change of a function with respect to a variable) of the activation function

- backpropagation and loss function

  - a loss function that helps you readjust the input weights and biases by comparing the predicted values (output) from the previous iteration with the actual received value

  - the goal is to minimize the loss function over each iteraction (improve prediction performance)

  - backpropagation is used to adjust the neuron weights by working backwards

  - backpropagation uses an Error Weighted Derivative formula determined by the activation function

▼ How many typical iterations for ANN training process?

is iterated upon no less than 10,000 times and sometimes more depending on the use-case

▼ After training, you can use the model for inference. Explain.

Inference is when the model/function is applied to new examples (for which we do not know the correct output value) and therefore we want the model to generate estimates of this value for us.

▼ Why does the use of Tensorflow often result in higher-dimensional (more layers and nodes) ANNs?

Tensorflow allows you to process much larger matrices

▼ What is the distinction made between ML and deep learning algorithms?

During training, a ML algorithm selects a function from a set of possible functions whereas in deep learning the function extracted will be represented as a neural network.