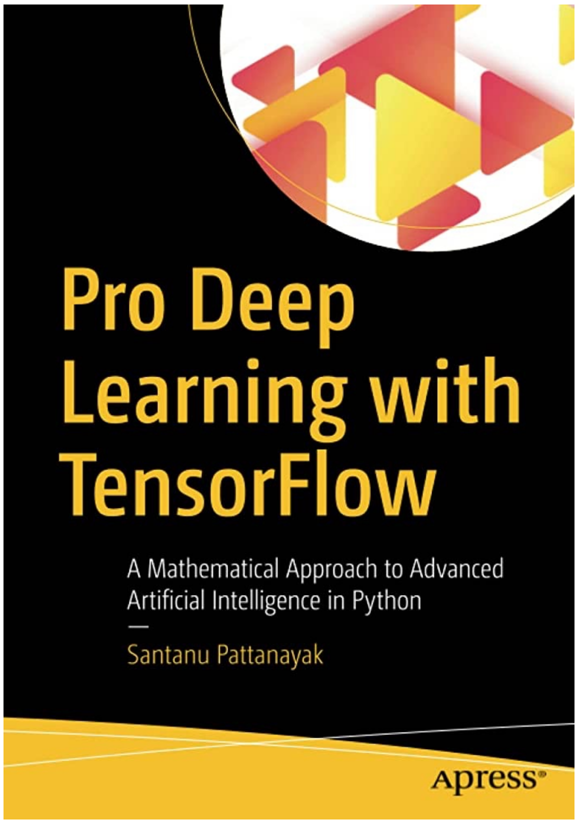

Motivation:- Paper for my internship this summer implementing state of the art deep learning algorithms.

- Gain the skills to do DL research in Berkeley.

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Technical Reviewer: Manohar Swamynathan. Author of Mastering ML with Python in 6 Steps. BS in Physics, Math, CS and MS in "Project management."

Introduction

- Deep Learning: Modeling the world in terms of a hierarchy of concepts.
  - → Just like the human brain, it allows us to model complex concepts that go unnoticed in traditional modeling techniques. Leverages huge amounts of unstructured data
  - ↳ Understanding the scientific and mathematical principles behind DL lets us maximize the "black box" power.
- Why TensorFlow?
  - ↳ Flexibility for research purposes and ease of use.
  - ↳ "Capability of loading models with ease in a live production environment using its serving capabilities."

- Goals of this book:
  1) Learn DL from scratch and deploy meaningful DL solutions.
  2) Using TensorFlow and optimizing different DL architectures.
  3) Use demonstrated prototypes to build new DL applications.
- Resources Provided:
  ↳ Example code is provided in iPython notebooks and scripts.

Table of Contents

- Language modeling. Using networks in real-world problems.
- Backpropagation for RNNs and LSTM's. Vanishing gradient problem.

Chapter 5: Unsupervised Learning with Restricted Boltzmann Machines and Auto-encoders

- Bayesian Inference and Markov Chain Monte Carlo (MCMC) methods. E.g Metropolis Algorithm and Gibbs sampling.
  - ↳ RBM training process requires understanding sampling.
  - ↳ Contrastive divergence
- Use of RBMs for collaborative filtering in recommender systems and in unsupervised pre-training of Deep Belief Networks (DBN).
- Types of autoencoders: Sparse encoders, denoising encoders, etc.
- Internal features from auto-encoders used for dimensionality reduction as well as supervised learning.
- Data preprocessing: PCA and ZCA.

Chapter 6: Advanced Neural Networks

- Fully convolutional NN's, R-CNN, Fast R-CNN, Faster, U-Net, etc.
  - ↳ Semantic segmentation, object detection, localization
- Image segmentation methods.
- Generative Adversarial Network (GAN)
  - ↳ Image generation, inpainting, abstract reasoning, semantic segmentation, video generation, inter-domain style transfer, text-to-image generation, etc.

Key Learnings from this Book:

- Understand full-stack deep learning using TensorFlow and gain a solid mathematical foundation for DL.
- Deploy complex deep-learning solutions in production w/ TF.
- Carry out research on deep learning and perform experiments w/ TF.

Chapter 1: Mathematical Foundations

Deep Learning

- Layers of artificial "neurons" stacked on top of each other to identify complex features from input data and solve complex real-world problems.
- Used for both supervised and unsupervised machine-learning tasks.
- Applications in areas like computer vision, video analytics, pattern recognition, anomaly detection, text processing, sentiment analysis, recommender systems, and more.
- Widespread use in robotics, self-driving car mechanisms, and AI systems in general.

Mathematics

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Machine Learning

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Deep Learning

- Selecting the right algorithm for a ML problem.
- Tuning ML/DL models better and understand reasons for unexpected performance.
- Linear Algebra (35%), Prob. and Stat. (25%), Calculus (15%), Optimization and Formulation of ML algorithms. (25%)

Linear Algebra

Mathematics that deals with vectors and their transformation to another vector space. Since ML and DL deals with multi-dimensional data, lin. alg. plays a crucial role in almost every ML and DL algorithm.

- Vector: Refer to Notability/Learnings/LinearAlgebra/MatrixBuildingBlocks
- Scalar: ″
- Matrix: ″
- Tensor: ″