

Math 514 Summer 2021

Syllabus

Math 514 will cover the basics of Neural Networks and Deep Learning. Programming will be in python using the PyTorch deep learning libraries. Students will be asked to complete a project and give a presentation at the end of the semester.

Optional Texts

Ian Pointer, *Programming PyTorch for Deep Learning*.
Rao & McMahan, *Natural Language Processing with PyTorch*

There will be no required reading from these texts, but they might be a useful references for your class project

Online References

Bishop, *Pattern Recognition and Machine Learning*, <https://www.microsoft.com/en-us/research/uploads/prod/2006/01/Bishop-Pattern-Recognition-and-Machine-Learning-2006.pdf>

Nielsen, *Neural Networks and Deep Learning*, <http://neuralnetworksanddeeplearning.com/>

Daume, *A Course in Machine Learning*, <http://ciml.info/>

Shalizi_1, *Advanced Data Analysis from an Elementary Point of View*, <https://www.stat.cmu.edu/~cshalizi/ADAfaEPoV/ADAfaEPoV.pdf>

Ng, Andrew *CS229 Lecture Notes*, <http://cs229.stanford.edu/notes/cs229-notes1.pdf>

Goodfellow, Bengio and Courville, <https://www.deeplearningbook.org/>

Krose, *An Introduction to Neural Networks*, <https://www.infor.uva.es/~teodoro/neuro-intro.pdf>

Videos

Ng, *Coursera Deep Learning Specialization*

<https://www.coursera.org/specializations/deep-learning>

Tutorials

Pytorch tutorials: <https://pytorch.org/tutorials/>

Google Colab: <https://www.geeksforgeeks.org/how-to-use-google-colab/>

| Class | Subject | Reading | Hwk | Due |
|--------------|--------------------------------------|-----------------------------|-----------------------|------------|
| 1 | Intro/Setup Bayes' Error | Bishop 1.2,2.3 | Watch AlphaGo | |
| 2 | Rule based learning | Daume, Ch 4 Bishop 4.1.4 | Hw1 – Perceptron | |
| 3 | Gradient Descent | Class Notes | None | |
| 4 | Regression | Shalizi Ch 11 Ng Notes | Hw2 – Regression | |
| 5 | Softmax | Ng Notes | None | |
| 6 | Multi-Layer 1 | Nielsen Ch 1,2 | Hw3 – ML Network | |
| 7 | Multi-Layer 2 | Nielsen Ch 3 | None | |
| 8 | Automatic Differentiation | tbd | Lab - Autodiff | |
| 9 | Pytorch | Pytorch Tutorials | Hw4 – Pytorch network | |
| 10 | RNN Recurrent Neural Networks | Class Notes | Lab – Seq2Sum | |
| 11 | CNN Convolutional Neural Networks | Class Notes | Hw - Project Proposal | |
| 12 | NLP Natural Language Processing | Class Notes | | |
| 13 | RL Reinforcement Learning | Class Notes | | |
| 14 | TBD – Speech to text | | | |
| 15 | Student Presentations | | | |