Deep Learning
Instructor : Dr. Kushal Shah

Before starting to learn Deep Learning, make sure to first learn basics of Machine Learning

Week	Topics	Primary YouTube Links	Other References
1	Artificial Neural Networks	ANN basics: https://youtu.be/6nkylSKqaAc https://youtu.be/ntnwjWEpnkk https://youtu.be/qctUEQn9Hj8 https://www.youtube.com/watch?v=llg3gGewQ5U Advanced ANN: https://www.youtube.com/watch?v=nUUqwaxLnWs https://www.youtube.com/watch?v=dXB-KQYkzNU https://www.youtube.com/watch?v=NE88eqLngkg https://www.youtube.com/watch?v=k8fTYJPd3_I https://www.youtube.com/watch?v=1waHlpKiNyY&list=PLkDaE6sCZn6Hn0vK8co82zjQtt3T2Nkqc https://www.youtube.com/watch?v=Gey9CG6R6w8 https://www.youtube.com/watch?v=Q1JCrG1bJ-A Deep Learning Intro: https://youtu.be/MTbBOu4M7_M	Universal Approximation Theorem: http://neuralnetworksanddeeplearning.com/chap4.html Activation functions: https://towardsdatascience.com/comparison-of-activation-functions-for-deep-neural-networks-706ac4284c8a Optimization Algorithms: https://arxiv.org/pdf/1609.04747 Loss Functions: https://towardsdatascience.com/understanding-different-loss-functions-for-neural-networks-dd1ed0274718 Vanishing Gradient Problem: https://towardsdatascience.com/the-vanishing-gradient-problem-69bf08b15484 Regularization for ANN: https://towardsdatascience.com/how-to-improve-a-neural-network-with-regularization-8a18ecda9fe3 Dropout: https://towardsdatascience.com/dropout-in-neural-networks-47a162d621d9 https://www.youtube.com/watch?v=qfsacbIe9AI Embedding layer vs Dense layer: https://medium.com/logivan/neural-network-embedding-and-dense-layers-whats-the-difference-fa177c6d0304 Difference between Brain and ANN: https://towardsdatascience.com/the-differences-between-artificial-and-biological-neural-networks-a8b46db828b7 https://medium.com/digital-catapult/are-artificial-neural-networks-like-the-human-brain-and-does-it-matter-3add0f029273 PyTorch: https://www.youtube.com/watch?v=Uv0AIRr3ptg

			https://colab.research.google.com/drive/1Pz8b_h-W9zIBk1p2e6v-YFYThG1NkYeS?usp=sharing TensorFlow: https://www.youtube.com/watch?v=OHZqmJwj7n4&list=PL9ooVrP1hQOFJ8UZl86fYfmB1_P5yGzBT https://www.tutorialspoint.com/tensorflow/index.htm House Price Prediction: https://medium.com/@robertjohn_15390/simple-housing-price-prediction-using-neural-networks-with-tensorflow-8b486d3db3ca Image recognition using ANN: https://nextjournal.com/gkoehler/digit-recognition-with-keras Backpropagation from scratch: https://machinelearningmastery.com/implement-backpropagation-algorithm-scratch-python/
2	Boosting Algorithms	https://www.youtube.com/watch?v=kho6oANGu_A https://www.youtube.com/watch?v=LsK-xG1cLYA https://www.youtube.com/watch?v=OtD8wVaFm6E https://www.youtube.com/watch?v=UHBmv7qCey4	https://www.geeksforgeeks.org/grownet-gradient-boosting-neural-networks/
3	Computer Vision - Basic CNN Model	https://www.youtube.com/watch?v=NmLK_WQBxB4 https://www.youtube.com/watch?v=QzY57FaENXg https://www.youtube.com/watch?v=HGwBXDKFk9I https://www.youtube.com/watch?v=2-Ol7ZB0MmU Backprop in CNN: https://www.youtube.com/watch?v=pUCCd2-17vI	NPTEL course on DL for CV by IITM: https://dl4cv-nptel.github.io/DL4CVBK/intro.html https://towardsdatascience.com/a-comprehensive-guide-to-convolutional-neural-networks-the-eli5-way-3bd2b1164a53 https://towardsdatascience.com/from-alexnet-to-nasnet-a-brief-history-and-introduction-of-convolutional-neural-networks-cf63bf3320e1 https://www.youtube.com/watch?v=KuXjwB4LzSA https://www.youtube.com/watch?v=umGJ30-15_A CNN Code references
4	Computer Vision - CNN Architectures	https://www.youtube.com/watch?v=DAOcjicFr1Y	https://www.geeksforgeeks.org/convolutional-neural-network-cnn-architectures/ https://medium.com/analytics-vidhya/cnns-architectures-lenet-alexnet-vgg-googlenet-resnet-and-more-666091488df5
5	Computer Vision - Autoencoders & GANs	https://www.youtube.com/watch?v=5WoItGTWV54	GANs for MNIST digits:

		https://www.youtube.com/watch?v=9zKuYvjFFS8	https://machinelearningmastery.com/how-to-develop-a-generative-adversarial-network-for-an-mnist-handwritten-digits-from-scratch-in-keras/ https://wiki.pathmind.com/generative-adversarial-network-gan
6	Computer Vision - Practical Considerations		https://towardsdatascience.com/convolutional-neural-networks-cnns-a-practical-perspective-c7b3b2091aa8
7	Sequence Modeling - RNNs and LSTMs I	RNN & LSTM Theory https://www.youtube.com/watch?v=6niqTuYFZLQ	RNN, LSTM & GRU: http://colah.github.io/posts/2015-08-Understanding-LSTMs/ http://karpathy.github.io/2015/05/21/rnn-effectiveness/ https://www.youtube.com/watch?v=WCUNPb-5EYI http://blog.echen.me/2017/05/30/exploring-lstms/ Dropout in RNNs: https://adriangcoder.medium.com/a-review-of-dropout-as-applied-to-rnns-72e79ecd5b7b RNN Regularization: https://arxiv.org/abs/1409.2329 https://stackoverflow.com/questions/48714407/rnn-regularization-which-component-to-regularize Word Embeddings: https://medium.com/@phylypo/a-survey-of-the-state-of-the-art-language-models-up-to-early-2020-aba824302c6
8	Sequence Modeling - RNNs and LSTMs II	RNN & LSTM Practical	RNN & LSTM Code https://karpathy.github.io/2015/05/21/rnn-effectiveness/ Stacked LSTMs: https://machinelearningmastery.com/stacked-long-short-term-memory-networks/ https://machinelearningmastery.com/return-sequences-and-return-states-for-lstms-in-keras/ LSTM Regularization: https://machinelearningmastery.com/use-weight-regularization-lstm-networks-time-series-forecasting/
9	NLP - Transformer Architecture and LLMs	https://www.youtube.com/watch?v=SZorAJ4I-sA https://www.youtube.com/watch?v=TQQlZhbC5ps https://www.youtube.com/watch?v=wjZofJX0v4M https://www.youtube.com/watch?v=eMlx5fFNoYc	https://jalammar.github.io/illustrated-transformer/ Is Attention explanation? Code for LLM Inference Tokenization using BPE, Unigram and WordPiece: https://blog.floydhub.com/tokenization-nlp/

		https://www.youtube.com/watch?v=QyFJWRnt_AY https://www.youtube.com/watch?v=UPtG_38Oq8o	BERT: https://medium.com/@mromerocalvo/dissecting-bert-part1-6dcf5360b07f https://www.youtube.com/c/ChrisMcCormickAI/videos http://jalammar.github.io/illustrated-bert/ GPT-3: https://towardsdatascience.com/gpt-3-a-complete-overview-190232eb25fd Annotated Transformer: http://nlp.seas.harvard.edu/2018/04/03/attention.html https://www.youtube.com/watch?v=Osj0Z6rwJB4&list=PLEJK-H61XlwxpfpVzt3oDLQ8vr1XiEhev&index=2 Positional Encoding: https://kazemnejad.com/blog/transformer_architecture_positional_encoding/ https://towardsdatascience.com/master-positional-encoding-part-i-63c05d90a0c3 https://towardsdatascience.com/understanding-positional-embeddings-in-transformers-from-absolute-to-rotary-31c082e16b26 LLM Notebooks by Anish: https://github.com/anishiisc/Build_LLM_from_Scratch/tree/main
10	NLP - LLM Pre-Training	https://www.youtube.com/watch?v=knTc-NQSjKA	Pre-Training and Fine-Tuning BERT MLM Task Details In-Context Learning Gen AI Hyperparameters LLM Model Details https://www.youtube.com/watch?v=kCc8FmEb1nY
11	NLP - Fine Tuning LLMs	https://www.youtube.com/watch?v=mw7ay38--ak https://www.youtube.com/watch?v=dzyDHMycx_c	Code for Fine-tuning BERT & LLaMA https://weightwatcher.ai Text Classification: https://www.thepythoncode.com/article/finetuning-bert-using-huggingface-transformers-python https://curiousily.com/posts/sentiment-analysis-with-bert-and-hugging-face-using-pytorch-and-python/

			https://towardsdatascience.com/https-medium-com-chaturangarajapakshe-text-classification-with-transformer-models-d370944b50ca NER: https://www.depends-on-the-definition.com/named-entity-recognition-with-bert/ https://towardsdatascience.com/named-entity-recognition-with-bert-in-pytorch-a454405e0b6a
12	NLP - Retrieval Augmented Generation	https://www.youtube.com/watch?v=wd7TZ4w1mSw&list=PLfaIDFEXuae2LXbO1_PKyVJiQ23ZztA0x https://www.youtube.com/watch?v=ahnGLM-RC1Y	Sentence Similarity using BERT and SBERT Limitation of IR using LLMs RAG using LangChain
13	Image Captioning, Text to Image	https://www.youtube.com/watch?v=JmATtG0yA5E https://www.youtube.com/watch?v=pea3sH6orMc	https://www.youtube.com/watch?v=fUSTbGrL1tc https://www.youtube.com/watch?v=LWIZj_RJYjM https://www.youtube.com/watch?v=aaP7JJZuvGs https://jalammar.github.io/illustrated-stable-diffusion/ https://www.youtube.com/watch?v=hCmka_vC7oA Diffusion Models : https://www.youtube.com/watch?v=9BHQvQlsVdE
14	Deployment		https://fullstackdeeplearning.com/course/2022/

Textbooks

Understanding Deep Learning by Simon Prince
Deep Learning by Ian Goodfellow, Yoshua Bengio & Aaron Courville
Deep Learning by Christopher Bishop and Hugh Bishop

References for NLP