



GUJARAT TECHNOLOGICAL UNIVERSITY

Syllabus for Integrated Master of Computer Applications, 8th Semester

Subject Name: Advance Machine Learning

Subject Code: 2688602

With effective
from academic
year 2020-21

Prerequisite

Required background knowledge includes probability theory, linear algebra, continuous mathematics, multivariate calculus and multivariate probability theory, as well as good programming skills. Students are required to have taken the Machine Learning course. The programming environment used in the lecture examples and practical will be Python/Tensor Flow.

Sr. No.	Content	Weightage %
Unit-1	<ul style="list-style-type: none">● Introduction of Deep Learning● Difference between Machine learning & Deep Learning, Neural Network Basics, Shallow Neural Networks, Key concepts on Deep Neural Networks, Implementing Gradient Descent, Training Neural Networks, Hyper parameters, Vanishing Gradient Problem, Exploding Gradient Problem.● Tenser flow, Theano, PlaidML, MXNet, CNTK, Keras.● OpenCV Installation and introduction, Read and save images, basic operation on Images, OpenCV Resize Image, OpenCV Image rotation, OpenCV Video capture.	25%
Unit-2	<ul style="list-style-type: none">● Deep learning: CNN, RNN, LSTM● Convolutional Neural Network , Backpropagation in CNNs, Evolution of CNN Architectures for Image Classification, Fintune CNN, Recurrent Neural Network, Long Short-Term Memory Network, Implementation of RNN & LSTM , Applications of Recurrent Neural Networks, Types of Recurrent Neural Networks,● Case Study: Deep Learning for Cancer Detection	20%
Unit-3	<ul style="list-style-type: none">● Deep Generative Model.● Generative Adversarial Networks (GAN): Generator, Discriminator, How do GAN work, Steps to training GAN, Applications of GAN.● Deep Convolutional GANs, PIX2PIX & CycleGAN	15%
Unit -4	<ul style="list-style-type: none">● Reinforcement Learning● Introduction Reinforcement Learning, key terms: Environment, state, Reward, Policy, Value. An Introduction to Sequential Decision-Making, Markov Decision Process, Value Functions & Bellman Equations, Q-learning, SARSA, DQNS , DDPG, Application of Reinforcement Learning.	20%
Unit -5	<ul style="list-style-type: none">● Introduction of NLP● Knowledge in Speech and Language processing, ambiguity and models and algorithm, language and understanding, brief history.	20 %



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	<ul style="list-style-type: none">Regular Expressions, Automata, Similarity Computation, Text Processing, Part of Speech Tagging with Hidden Markov Models, sequence tagging, Feature Extraction and Embeddings, Text sequence modeling and Deep Learning, Vector Space Models of Semantics, Sequence to sequence tasks, Argmax based computations. Words and Word Forms : Morphology fundamentals; Web 2.0 Applications : Sentiment Analysis; TreeBank, PropBank, WordNet, VerbNet etc.	
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Sample Practical List

1. Creating our own simple neural network.
 2. Reading images in OpenCV using python.
 3. Display an image in OpenCV using python.
 4. Writing an image in OpenCV using python.
 5. Take pictures from a camera via OpenCV using python.
 6. Face detection via OpenCV using python.
 7. gesture recognition opencv python
 8. Image classification using ANN
 9. Image classification using CNN
 10. Object Detection using CNN
 11. Human Pose detection using CNN
 12. CNN form segmentation.
 13. Sentimental analysis using RLL
 14. Generative Adversarial Networks (GAN) using keras in python
 15. Sentiment Analysis using LSTM.
 16. Text Classification With Python and Keras
 17. Desirable practical
- Introduction to Deployment
 - Deploy a Model, Custom Models & Web Hosting, Model Monitoring, Updating a Model.

Resources:

<https://colab.research.google.com/>

<https://cloud.google.com/products/ai>

<https://www.kaggle.com/>

<https://aws.amazon.com/free/machine-learning/>

<https://studio.azureml.net/>

Dive into Deep Learning : <https://d2l.ai/d2l-en.pdf>

Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016



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https://www.amazon.com/GANs-Action-learning-GenerativeAdversarial/dp/1617295566/ref=as_li_ss_tl?keywords=Generative+Adversarial+Network&qid=1559094543&s=books&sr=1-1&linkCode=sl1&tag=inspiredalgor20&linkId=14dced5a1ca81a9d4268b23dfd45acc&language=en_US

Reference website for learning:

<https://playground.tensorflow.org/>

<https://www.tensorflow.org/resources/learn-ml>

<https://developers.google.com/machine-learning/crash-course>

<https://aws.amazon.com/free/machine-learning/>

<https://developer.nvidia.com/deep-learning>

<https://www.nvidia.com/en-in/training/>

<https://www.nvidia.com/en-in/ai-data-science/>

<https://docs.microsoft.com/en-us/azure/machine-learning/overview-what-is-azure-machine-learning>

<https://keras.io/>

<https://opencv.org/>

<http://demo.clab.cs.cmu.edu/NLP/>

<https://towardsdatascience.com/a-practitioners-guide-to-natural-language-processing-part-i-processing-understanding-text-9f4abfd13e72>

<https://algorithmia.com/blog/introduction-natural-language-processing-nlp>

References:

1. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
2. Hal Daume III, A Course in Machine Learning, 2015 (freely available online)
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer, 2009
4. John Hopcroft, Ravindran Kannan, Foundations of Data Science, 2014 (freely available online)
5. Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition.
6. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds
7. Daniel Jurafsky and James H. Martin Speech and Language Processing (2nd Edition), Prentice Hall: 2nd edition, 2008.
8. Machine Learning for Text by Charu C. Aggarwal, Springer, 2018 edition.
9. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media; 1st edition, 2009



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10. Generative Adversarial Networks Projects: Build next-generation generative models using TensorFlow and Keras by Kailash Ahirwar
Web resource
<https://github.com/PacktPublishing/Generative-Adversarial-Networks-Projects>
11. Reference Text:
Getting Started with Deep Learning for Natural Language Processing by Sunil Patel,
BPB Publication

Course Objective

- CO1. Be able to implement and evaluate common neural network models for language.
- CO2. Understand neural implementations of attention mechanisms and sequence embedding models and how these modular components can be combined to build state of the art NLP systems.
- CO3. Have an understanding of how to choose a model to describe a particular type of data.
- CO4. Be able to design and implement various machine learning algorithms in a range of real-world applications.