Pattern Recognition & Machine Learning

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Prerequisites

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- Calculus
- Probability & random variables
- Basic understanding of random processes & DSP

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    - EE5610 PRML - Elective for EE PG & UG students
    - EE2802 ML - Softcore for EE BTech 2nd Yr students
    - AI5000 Foundations of ML - AI PG Students
    - AI3102 Sequence models (5-6 segments) - AI UG

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- Similar courses
  - EE7390 - Renumbered as EE5610 (100% overlap)
  - AI5000 (80% overlap)
  - EE5600, EE5601 & EE5602 (60-70% overlap)

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    - Write a "parameterized" program, and let the "learning algorithm" find the best set of parameters to approximate the desired behavior

Learning Paradigms

- Supervised learning (learning with a teacher)
    - Given training examples of input-output pairs, produce "correct" output for a new input
    - **Regression**: The output takes continuous values
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- Reinforcement learning (learning with a critic)
  - Take inputs from the environment and perform actions
  - Actions may be suitably rewarded or punished
  - Perform a sequence of actions that maximize the reward

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    - Cover's theorem, Nonlinear kernel transformation, fixed vs data-driven kernels, feed-forward neural networks, error back-propagation, practical issues in training DNNs
- (If time permits) Unsupervised learning
    - Clustering, density estimation, Gaussian mixture models, dimensionality reduction, autoencoders and its variants

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- Sequence models (V2)
  - Convolutional neural networks (CNN), recurrent neural networks (RNN), long-short term memory (LSTM), gated recurrent units (GRU), attention mechanism, autoregressive feed-forward networks and transformers
- Either V1 or V2 will be followed in 5-6 segments

Evaluation Criteria

- Homework - 20%
    - Summarize every lecture in your own words/examples
    - Complete all partial derivations/proofs
    - Hand written summary should be submitted on the same day of lecture
- Programming assignments - 20%
    - Programming assignments have to be done in Python.
    - Skeleton structure of the code will be posted on Google Colab
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- Delayed submissions will be penalized with a factor of 0.5 per day

Thank You !