

# LECTURE #1.

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## Deep Learning

### 1. Administrative:

- a) Instructor: Bud Mishra.  
mishra@nyu.edu.  
715 Broadway, Room 1003
- b) Mondays: 6<sup>00</sup> pm - 7<sup>30</sup> pm.  
(Dinner at 8<sup>00</sup> pm)



### c) Topics:

a) Background: LEARNING THEORY.

Linear Models / Linear Alg.  
Probability / Info Theory  
Optimization (Numerical Analysis)  
Machine Learning

- Bias-Variance Tradeoff.

- Supervised and  
Unsupervised Methods.

Neural Networks.

Regularization

Training NN's (Deep NN's)

TRICKS OF THE TRADE.

- b) CATEGORIES / Specialization:
  - Structured Probabilistic Models
  - Transfer Learning
  - Convolutional Networks
  - Recurrent / Recursive Nets

- c) GEOMETRY / Manifold Hypothesis.
  - Autoencoder.
  - Distributed Representation
  - Contrastive Divergence (Partition function)
  - Approximate Inference
  - Deep Generative Models

- d) PRACTICAL ISSUES
  - Scaling / GPU
  - Large Scale Deep Learning
  - Practical Methodologies

- e) CONNECTIONS:
  - Manifold Learning
  - Persistent Homology
    - ~ TDA (Topological Data Analysis)



# APPLICATIONS

Natural Language (Linguistics) { Dynamics  
Link Grammar  
SCOPE.

Cancer Data { Temporal/  
Heterogeneous/  
Ensemble.

Adtech Data (AMP) → Ranking (Relevance)

Cyber Security { Signaling Games.

Privacy { TAGGING  
(Obfuscation)

Fintech { Illiquid Markets.

Artificial Intelligence { ?

Augmented Intelligence Verifiers / Recommenders. { Boosting  
GAME THEORY