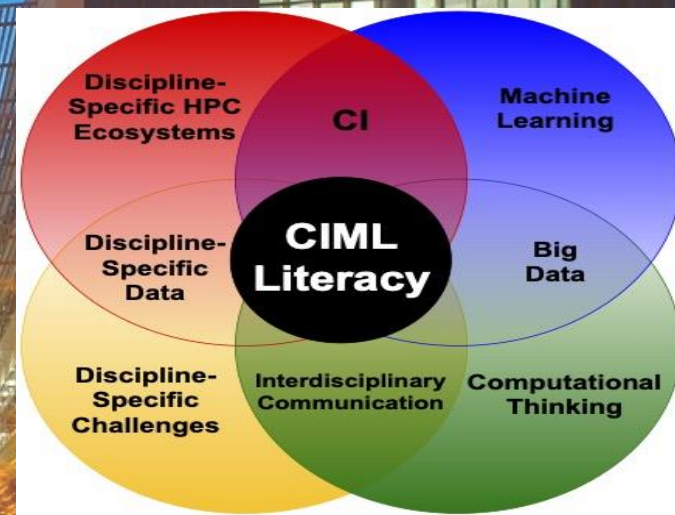


# Machine Learning/Deep Learning Schedule Overview

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# What is Machine Learning?

**We often say something like:**

Programs that learn from data (as opposed to being given rules)

Statistical Learning (as opposed to Statistical Inferencing)

**Or, we often just use certain terms:**

Supervised/Unsupervised; Classification/Regression;  
Overfitting/Regularization; Data Prep; Hyperparameters; etc..

**Or, we often talk about algorithm functions like:**

fit(); predict(); evaluate(); etc...

# Other computational frameworks with parameters, some learning, and predictions

- Probabilistic Reasoning
- Reinforcement Learning
- Simulations of Physical Systems
- Agent modeling
- Network Analysis
- Time Series Regression Analysis
- Databases and Business Analytics

*HPC with ML and Deep Networks are sometimes part and parcel of these*

# The HPC & Machine Learning landscape

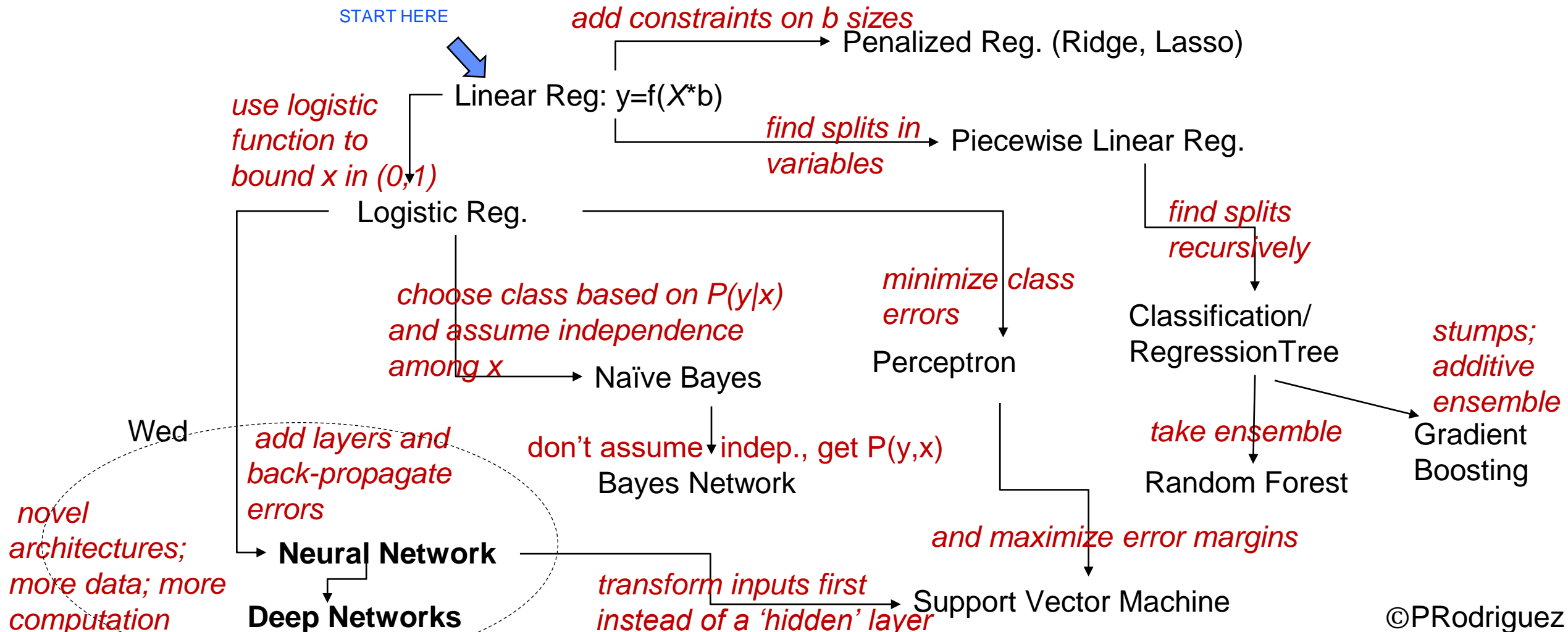
## Why use HPC?

Big data and/or Big computation

Possibilities for parallelization; eg distributing data and/or computation

*For ML models parallelization often depends on the algorithm to fit parameters*

# ML Model Space Map – in a nutshell



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# ML Model Space Map – in a nutshell

START HERE

*add constraints on  $b$  sizes*

Penalized Reg. (Ridge, Lasso)

**It all comes down to this:**

*Adding complexity to a model is good*

**BUT**

*More complexity leads to more overfitting*

**SO**

*To avoid overfitting, need more data, regularization, and/or smart/efficient parameter fitting*

*stumps;  
additive  
ensemble*

Gradient  
Boosting

Random Forest

*and maximize error margins*

Support Vector Machine

*transform inputs first  
instead of a 'hidden' layer*

Bayes Network

*back-propagate  
errors*

Neural Network

Deep Networks

We

*novel  
architectures;  
more data; more  
computation*

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# Schedule overview

- **Today - Scaling**

- R on HPC with Demo, some references to other packages
- Spark with Tutorials

- **Wednesday – Deep Learning**

- Intro to NN/CNN/Deep Learning
- Intro DL, MNIST and Parameter Tuning Exercises
- DL Layers and Models
- DL Transfer Learning with Exercises
- DL Functional API, Special Connections with Exercise (skip connections)