AI Module 3
Artificial Intelligence Lab

Data Wrangling Patterns
- Feature Encoding
- Feature Imputation
- Feature Scaling
- Text Representation
- Dimensionality Reduction

Unsupervised Learning Patterns
- Pattern Identification
- Content Filtering

Model Evaluation Patterns
- Training Performance Evaluation
- Prediction Performance Evaluation
- Baseline Modeling

Model Optimization Patterns
- Overfitting Avoidance
- Frequent Model Retraining
- Transfer Learning

Supervised Learning Patterns
- Supervised Network Configuration
- Image Recognition
- Sequence Identification

Artificial Intelligence
- Business Drivers
  - Need for Improved Decision Making
  - Need to Delegate Decision Making
  - Need for Adaptivity
  - Need to Predict and Adapt to Malicious Behavior
- Technology Drivers
  - Artificial Neural Networks
  - High-Performance and Inexpensive Infrastructure
  - Diverse Algorithms
- Benefits
  - Informed, Accurate and Responsive Decision Making
  - Responsive Business Solutions
  - Self-Learning and Adaptive Solutions
  - Autonomous Solutions
  - Automated Management
  - Emulating Human Behavior
  - Identifying and Responding to Malicious Behavior
  - Solving Problems of Higher Complexity
- Challenges
  - Learning Curve and Incomprehensible Decision Making
  - Distrust by Humans
  - Data Hosting and Access Restrictions
  - Quality Assurance
- Types
  - Narrow AI
  - General AI
  - Reactive Machine
  - Limited Memory
  - Theory of Mind
  - Self-Awareness
- Approaches
  - Symbolic
  - Non-Symbolic
- In the Industry
  - Machine Learning
  - Deep Learning
  - Business Intelligence
  - Big Data
- Common AI System Design Principles
- Common AI Project Best Practices

Common AI Practices
- Computer Vision
- Pattern Recognition
- Robotics
- Natural Language Processing (NLP)
- Natural Language Understanding (NLU) Speech Recognition
- Frictionless Integration
- Fault Tolerance Model Integration

Common AI Learning Approaches
- Supervised Learning
- Unsupervised Learning
- Semi-Supervised Learning
- Continuous Learning
- Reinforcement Learning
- Heuristic Learning

Neural Networks
- Components
  - Neurons
    - Input
    - Backfed Input
    - Noisy Input
    - Hidden
    - Probabilistic Hidden
    - Spiking Hidden
    - Recurrent
    - Memory
    - Recurrent Memory
    - Different Memory
    - Kerne
    - Convolution Kernel or Pool
    - Output
    - Match Input/Output
  - Activation Functions
    - Sigmoid
    - Tanh
    - ReLU
    - Leaky ReLU
    - Softplus
    - Softmax
  - Layers
    - Input
    - Hidden
    - Output
- Links
- Weights
- Training Neural Network Models
- Architecture Types
  - Fundamental Neural Network Architectures
    - Perceptron (P)
    - Feedforward (FF)
    - Radial Basis Forward (RBF) *
    - Deep Feedforward (DFF)
  - Architectures with Encoding and Decoding Layers
    - AutoEncoder (AE)
    - Sparse AE (SAE) *
    - Variational AutoEncoder (VAE) *
    - Denoising AutoEncoder (DAE) *
  - Recurrent Cell-based Architectures
    - Recurrent Neural Network (RNN)
    - Echo State Network (ESN) *
  - Memory-Influenced Architectures
    - Long/Short Term Memory (LSTM)
    - Neural Turing Machine (NTM) *
  - Parabolicity Cell-Driven Architectures
    - Markov Chain (MC) *
    - Boltzmann Machine (BM)
    - Restricted Boltzmann Machine (RBM)
    - Deep Belief Network (DBN)
  - Pool and Kernel Influenced Architectures
    - Deep Convolutional Network (DCN)
    - Deconvolutional Network (DN) *
    - Deep Convolutional Inverse Graphics Network (DCIGN) *
  - Hidden Cell Connection Architectures
    - Extreme Learning Machine (ELM)
    - Deep Residual Network (DRN)
    - Support Vector Machine (SVM)
    - Kohonen Network (KN)
  - Other Architectures
    - Hopfield Network
    - Generative Adversarial Network (GAN)
    - Liquid State Machine (LSM)

** These neural network architecture types are covered in the Neural Networks Supplement that accompanies the Module 1: Fundamental Artificial Intelligence course booklet.*

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Official Mind Map Supplement

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