

# Artificial Intelligence

## An Overview of AI and Machine Learning

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# 3-Part Online Training Series Overview

1. Artificial Intelligence - AI For Business
  - What, how, and why of AI
  - Organizational readiness, costs, risks, assumptions, considerations
  - Hype vs reality, and future of AI
2. Artificial Intelligence - An Overview of AI and Machine Learning
3. Artificial Intelligence - Real-World Applications
  - Real-world applications and examples
    - Prediction, recommendations, recognition, CV, natural language and much more!

# Course Overview

- AI Definitions and Related Concepts
- Machine Learning Definition
- Machine Learning Types & Algorithms
- AI Types and Algorithms
- AI and Machine Learning Process
- Tradeoffs and Considerations
- Summary and Next Steps

# Artificial Intelligence Definition

## Intelligence

*Learning, understanding, and the application of the knowledge learned to achieve one or more goals*

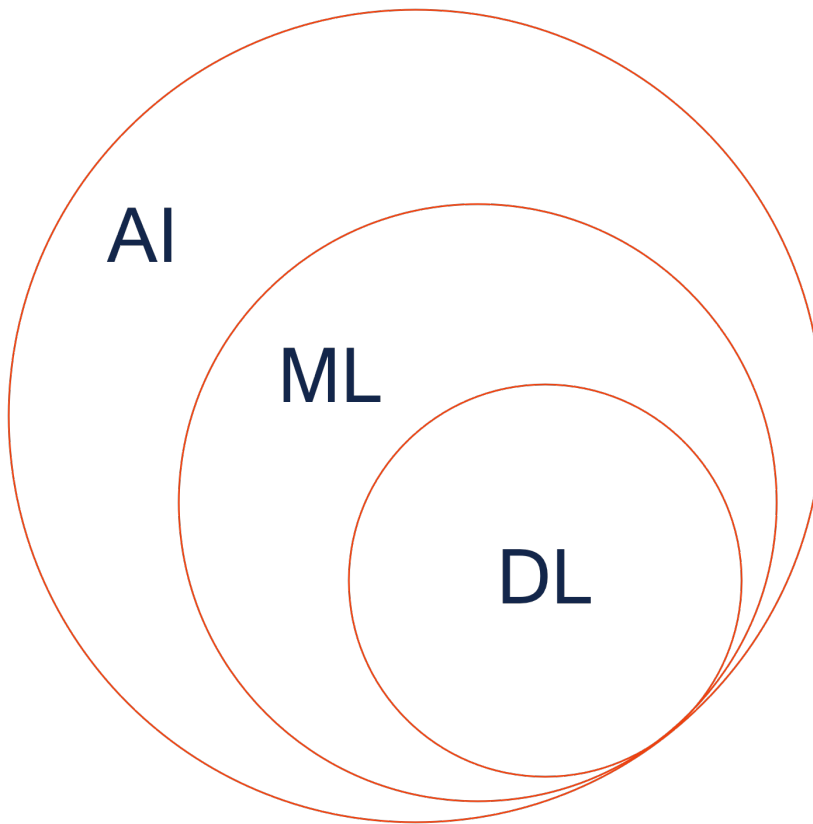
## Artificial Intelligence

*Intelligence exhibited by machines  
Also known as cognitive computing*

## Related Fields

*Neuroscience, psychology, philosophy,  
mathematics, statistics, computer science*

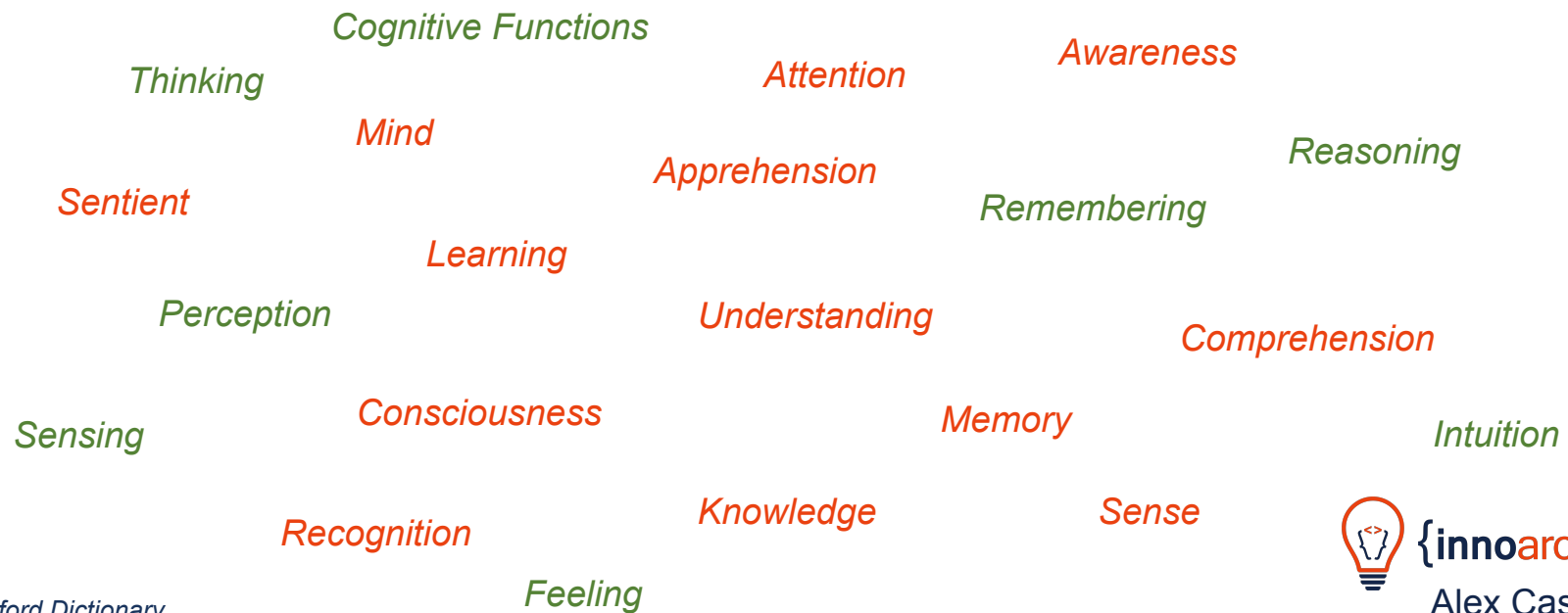
# AI vs ML vs DL



*No explicit programming*

# Artificial Intelligence Concepts

**Cognition** *The mental action or process of acquiring knowledge and understanding through thought, experience, and the senses.*



<sup>1</sup> Oxford Dictionary

# Machine Learning Definition

## *Non-Technical*

Automatically Learn from data, and be able to improve knowledge learned from experience, without explicit programming or domain expertise.

## *Technical*

Machine learning algorithms learn a target function that maps input variables to output variables (mapping function)

# Machine Learning Definition Cont.

## Parametric

Type of optimization problem

- Assumed model form (params, functions, ...)
- Learn optimal parameters (aka coefficients)

$$Y_i = \beta_0 + \beta_1 X_i$$

Target

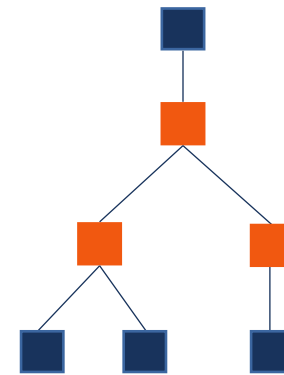
Param 1

Param  
2

Data / Feature

## Non-Parametric

No assumed model form



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# Machine Learning Data

*Labeled Data*

F1	F2	F3	...	Target
A	1	Yes		Spam
B	2	No		Ham

*Unlabeled Data*

F1	F2	F3	F4	F5
A	1	Yes	0	Red
B	2	No	1	Blue

# Machine Learning Types

## Supervised (Labeled)

*Stock Price*

Regression

Classification

*Spam or Ham?*

## Unsupervised (Un-labeled) & Semi-Supervised

*Customer Groups*

Clustering

Anomaly Detection

*Fraud/Cybersecurity*

## Reinforcement Learning

*Gaming, Robotics, Automation, ...*



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# Other Learning Types and Methods

*Deals recommended for you*

*Customers who viewed this item also viewed*

*Add to your feed*

*Suggestions for you*

Recommender Systems

*Spotify Daily Mix*

Collaborative

Content

Ensemble Methods

Bagging

Boosting

# Algorithms

*Naïve Bayes*

*Random Forests*

*Principle Component Analysis (PCA)*

*K-Means*

*Support Vector Machines (SVM)*

*Logistic Regression*

*K Nearest Neighbors (KNN)*

*Simple and Multiple Linear Regression*

*Hidden Markov Models*

*Decision Trees*

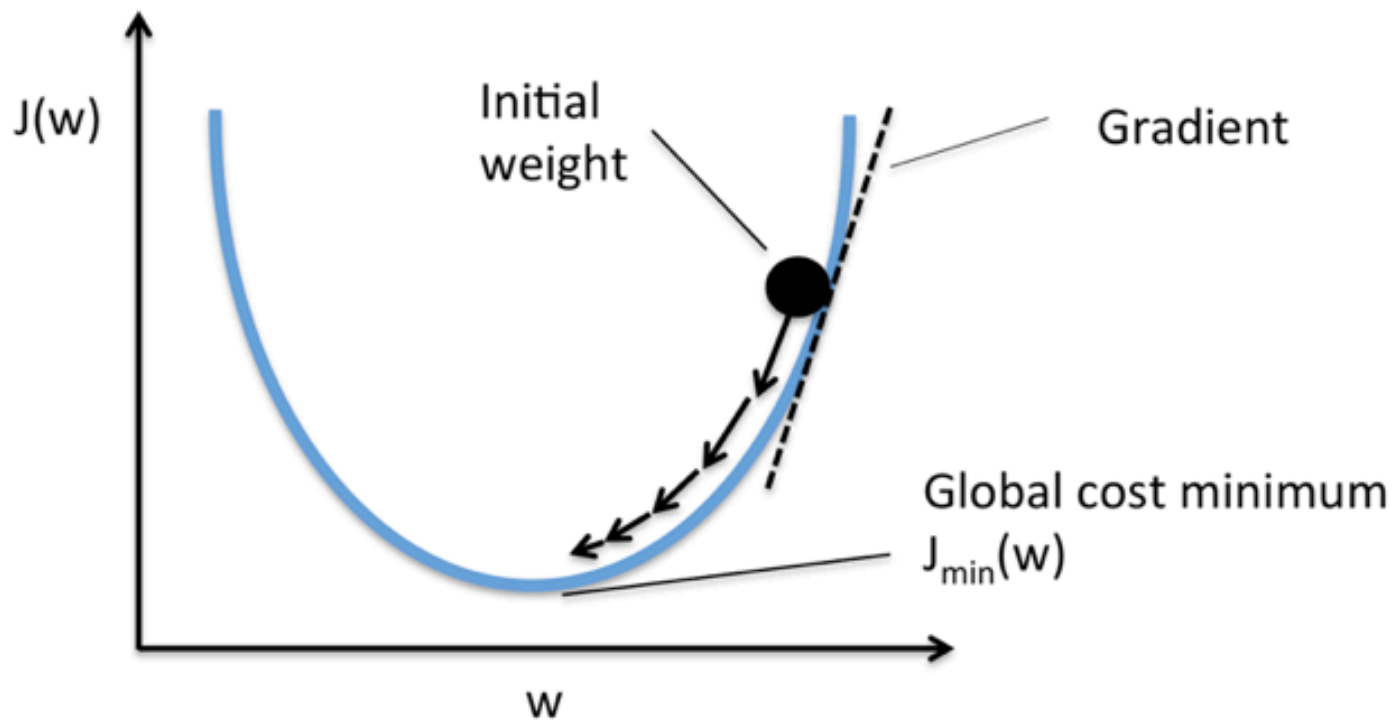
*ExtraTrees*

*Gaussian Mixture Model*

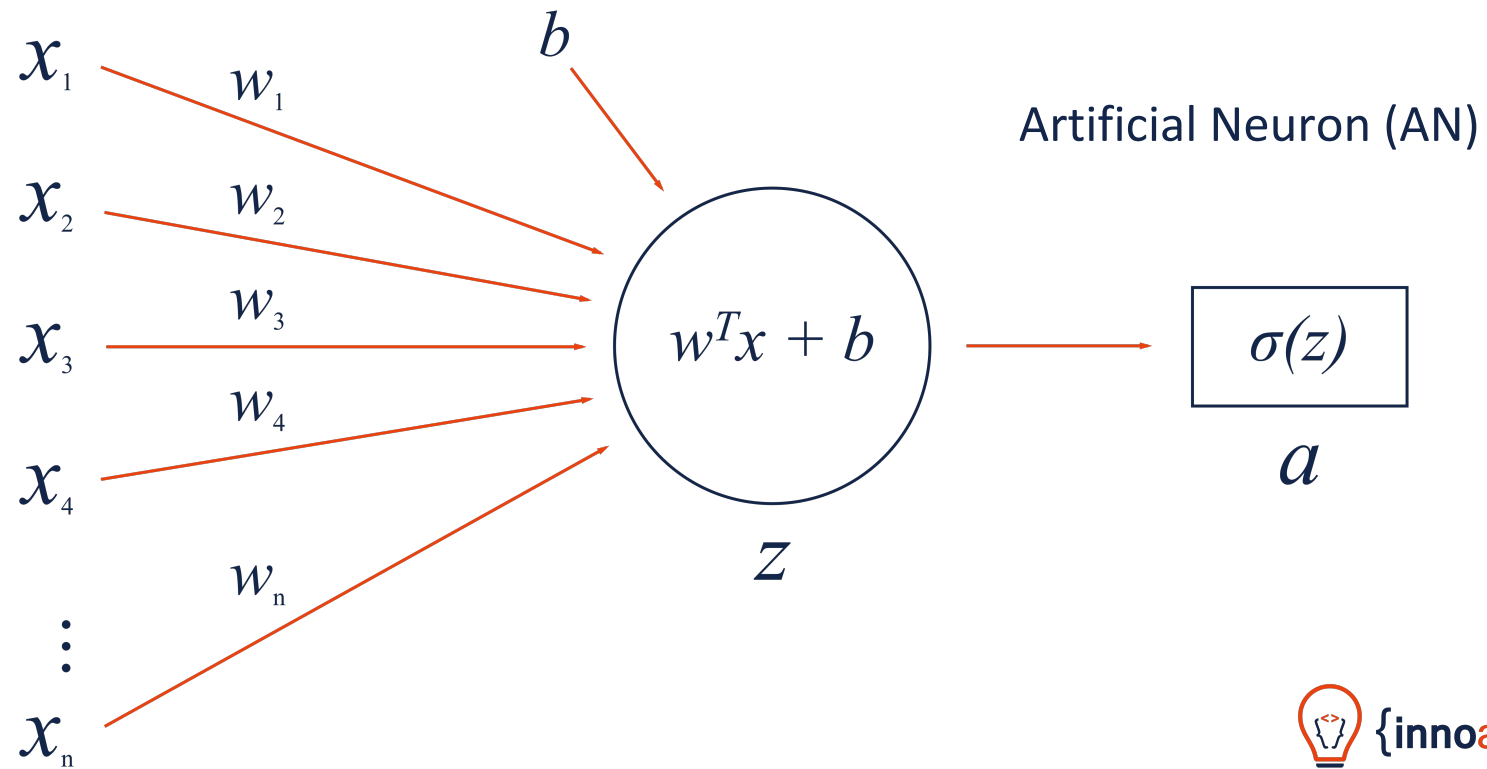
*Neural Networks*

*Generalized Linear and Additive Models (GLM/GAM)*

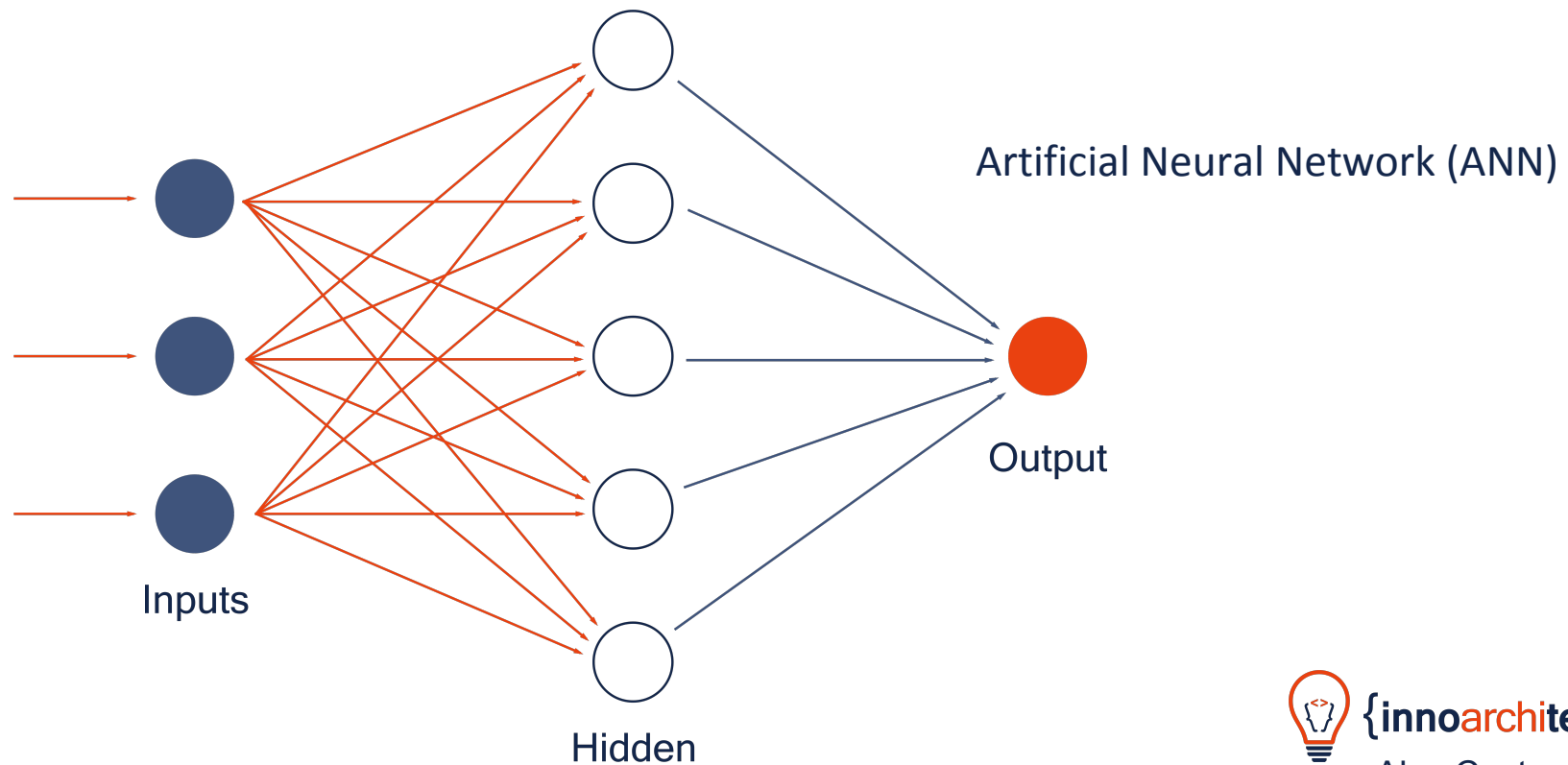
# Gradient Descent



# Artificial Neural Networks & Deep Learning



# Artificial Neural Networks & Deep Learning



# AI Types and Algorithms

## Types

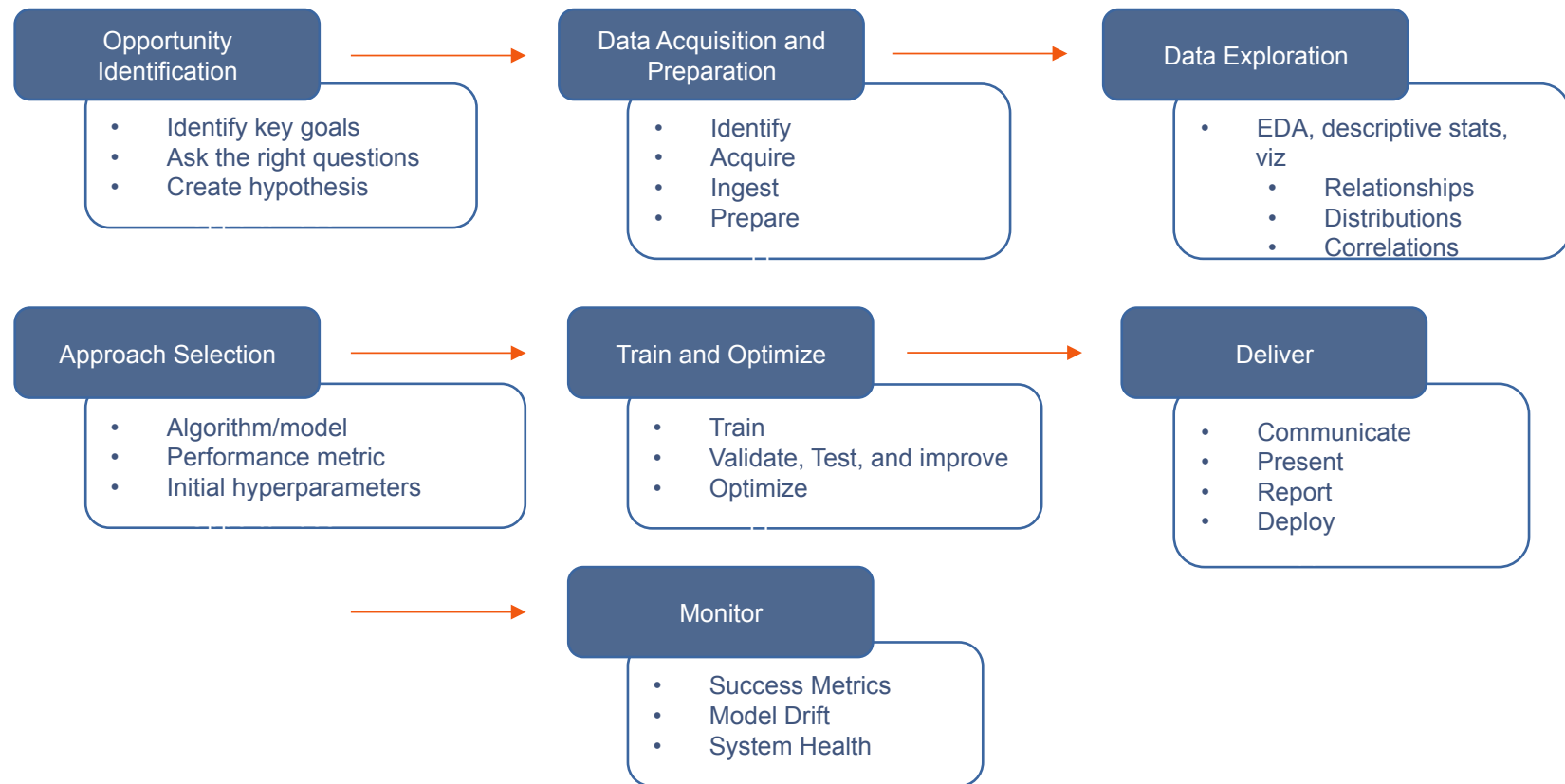
- Weak/Narrow
- Deep
- Shallow
- Applied
- Hard, Complete
- AGI, Strong, Full

## Algorithms

- Neural Networks
  - Convolutional (CNN)
  - Recurrent (RNN)
  - ...
- Deep Learning
- Transfer Learning



# The ODE-ATDM Machine Learning Process

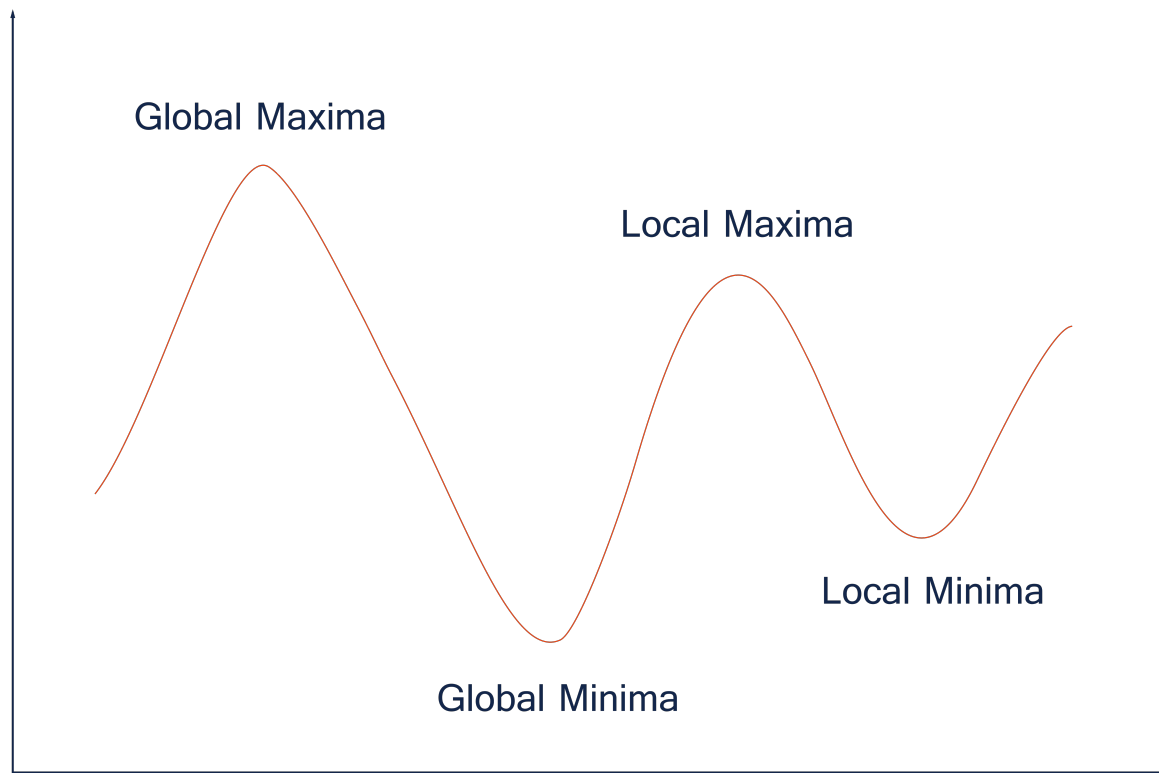


# Tradeoffs and Considerations

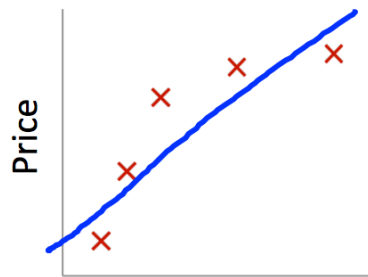
- Model
  - Overfitting vs underfitting (bias/variance)
  - Performance vs interpretability/explainability (black box)
  - Complexity vs simplicity (parsimony)
- Data and features
  - Representative and balanced
  - Adequate quantity, depth, and completeness
  - Intractability (data, algorithm, feature engineering)
- Performance
  - Error tradeoffs
- Output
  - Numeric
  - Binary or probability classifier

*(Non-exhaustive)*

# Global vs Local Minima

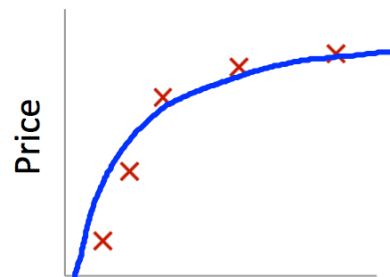


# Overfitting vs Underfitting



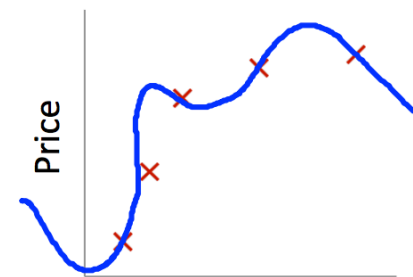
Size  
 $\theta_0 + \theta_1 x$

High bias  
(underfit)



Size  
 $\theta_0 + \theta_1 x + \theta_2 x^2$

“Just right”

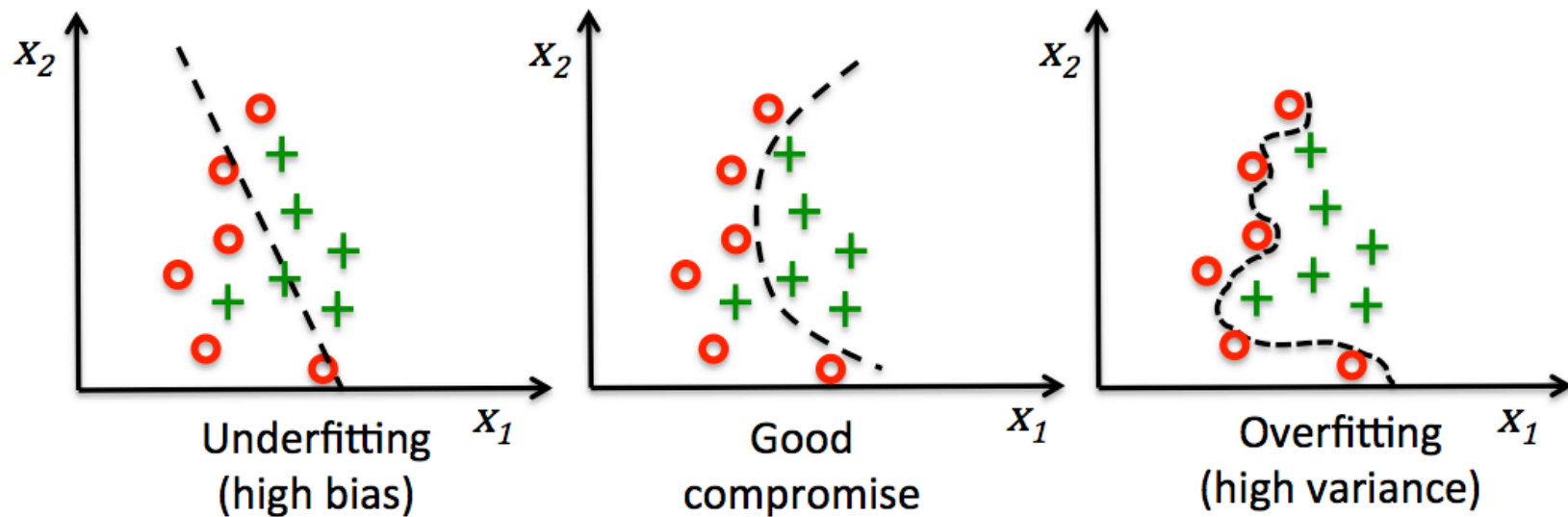


Size  
 $\theta_0 + \theta_1 x + \theta_2 x^2 + \theta_3 x^3 + \theta_4 x^4$

High variance  
(overfit)

*Regression*

# Overfitting vs Underfitting Cont.




*Classification*

# Summary and Next Steps

- Artificial intelligence and machine learning are
  - Incredibly powerful fields that can drive innovation and the creation of amazing new products and services
  - Fields that can benefit both businesses and customers alike
  - Going to become more ubiquitous and important over time
  - Important to understand, even if at a high level only
- Continue learning about AI
  - Artificial Intelligence: AI For Business
  - Artificial Intelligence: Real-World Applications

# Q&A

## *To Learn More*

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