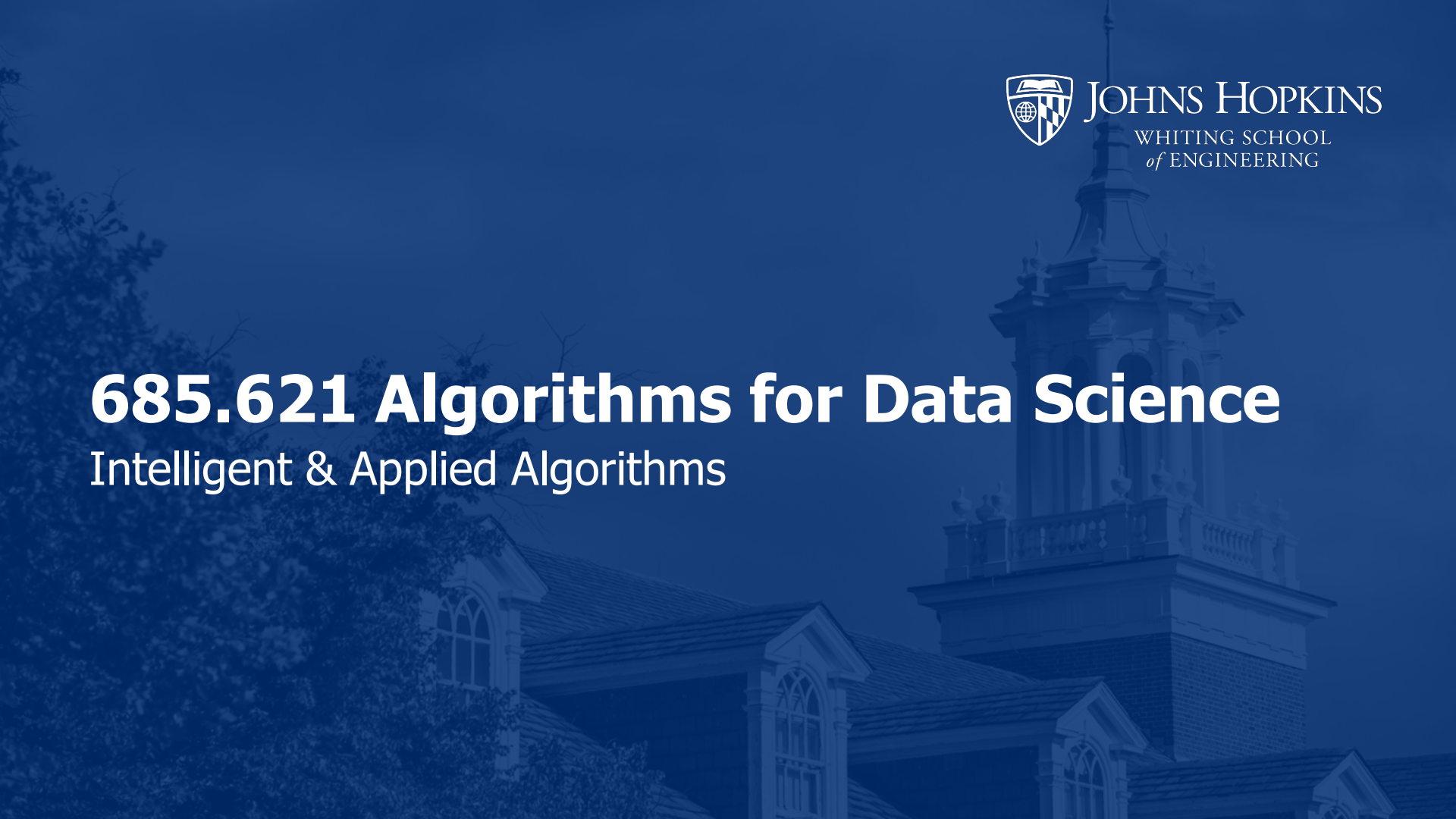
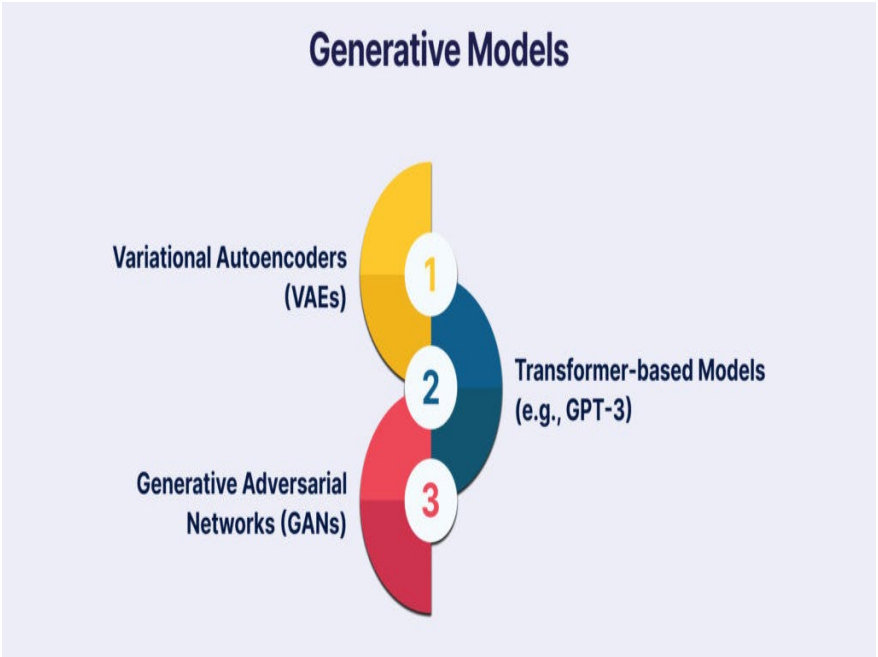


685.621 Algorithms for Data Science

Intelligent & Applied Algorithms

Module Learning Objectives

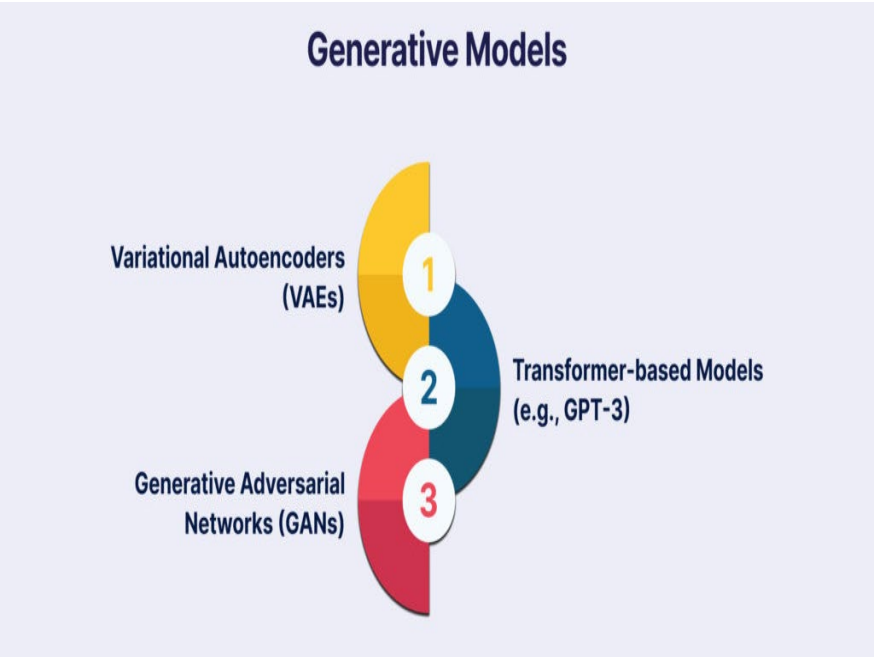
- 12.1 Explain the core principles and architectures of generative models, including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Sequence-to-Sequence (Seq2Seq) models.
- 12.2 Analyze the computational complexity and trade-offs associated with different intelligent algorithms, assessing factors such as training stability, scalability, and interpretability.
- 12.3 Apply pre-trained models from HuggingFace and TensorFlow Hub to real-world tasks, including data generation and sequence modeling, by configuring inputs, interpreting outputs, and evaluating loss functions.
- 12.4 Compare and contrast the learning objectives, optimization strategies, and performance characteristics of GANs, VAEs, and Seq2Seq models in various application contexts.



SoluLab, 2025

Module Learning Objectives

- 12.5 Evaluate the suitability of intelligent algorithms for specific AI applications, such as recommendation systems, creative AI, and language processing, considering both technical and ethical factors.
- 12.6 Interpret the behavior of complex models by examining outputs and diagnostic metrics to inform model tuning and selection decisions.
- 12.7 Design an intelligent algorithm pipeline by selecting appropriate pre-trained models, configuring evaluation strategies, and reflecting on model limitations and deployment considerations.



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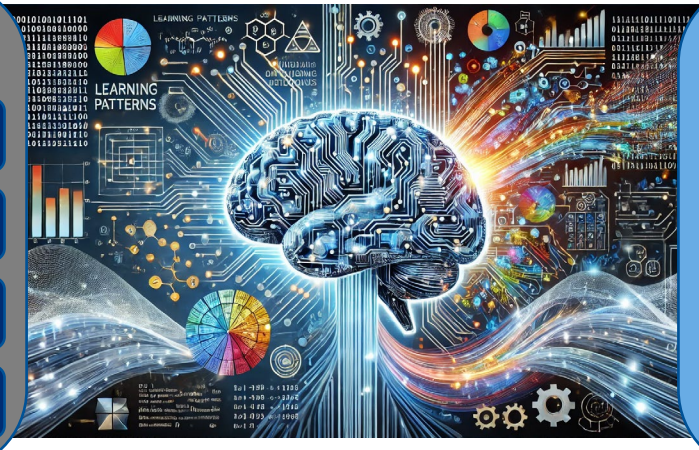
Intelligent Algorithms: An Overview

Intelligent algorithms are a class of computational techniques designed to learn patterns, make predictions, generate data, and optimize decisions based on complex input data.

Key Features

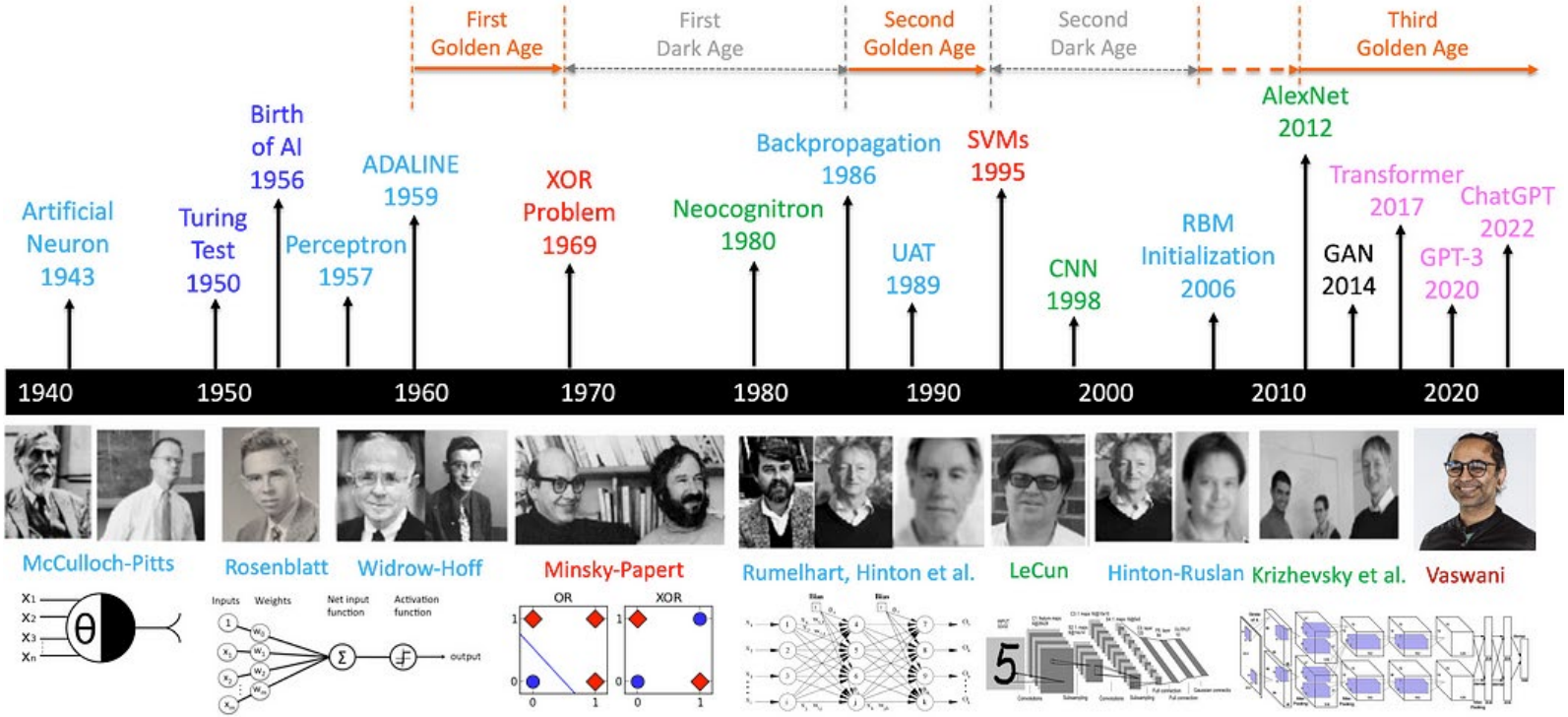
- Adaptable Overtime
- Minimal Human Intervention
- Generalizable
- Scalable



Applications

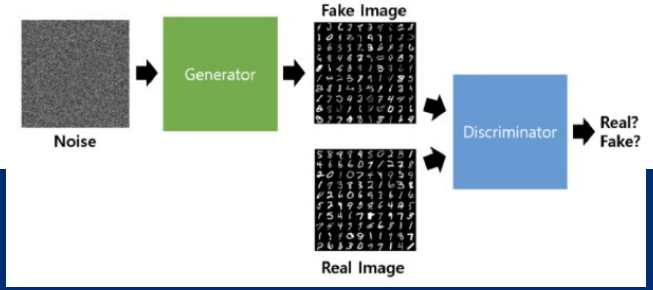
- Computer Vision
- Natural Language Processing
- Robotics

The Major Break Through Timeline

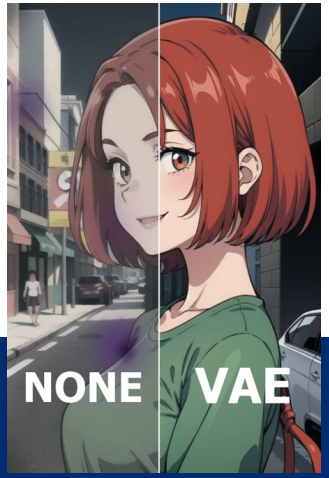


Medium, 2024

Key Topics



- Generative Adversarial Networks (GANs) - AI models that generate realistic synthetic data.



- Variational Autoencoders (VAEs) - Probabilistic generative models that encode and reconstruct complex data distributions.

- NLP Sequence-to-Sequence Models - Architectures like attention-based mechanisms for tasks such as machine translation and text summarization.