Radiation Therapy in the Era of Artificial Intelligence
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Introduction and History of AI

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AI, Machine Learning, and Deep Learning

Deep Learning
The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural networks to vast amounts of data.

Machine Learning
A subset of AI that includes abstruse statistical techniques that enable machines to improve at tasks with experience. The category includes deep learning.

Artificial Intelligence
Any technique that enables computers to mimic human intelligence, using logic, if-then rules, decision trees, and machine learning (including deep learning).
Machine Learning Categories

Unsupervised Learning
- Dimensionality Reduction
- Clustering
- Customer Segmentation

Supervised Learning
- Classification
- Regression
- Customer Retention

Reinforcement Learning
- Real-time decisions
- Robot Navigation
- Learning Tasks
- Game AI
- Skill Acquisition

Machine Learning Categories
- Meaningful Compression
- Structure Discovery
- Feature Elicitation
- Big Data Visualization
- Targeted Marketing
- Recommender Systems
- Advertising Popularity Prediction
- Weather Forecasting
- Market Forecasting
- Population Growth Prediction
- Estimating Life Expectancy
History of AI

Family of Machine Learning Algorithms

https://noeliagorod.com/2020/03/16/a-tour-of-machine-learning-algorithms/
The Breakthrough to Deep Learning

- Key components: GPUs and labeled data
  - GPU explosion in the mid 2000s
    - Original intent for graphics processing
    - Found to fit scientific computing needs
  - ImageNet
    - Millions of labeled images
    - 2009 poster presentation in Florida
The Breakthrough to Deep Learning

- Large Scale Visual Recognition Challenge
  - Used ImageNet
The Breakthrough to Deep Learning

- Large Scale Visual Recognition Challenge
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The jungle of neural networks

A mostly complete chart of Neural Networks

Perceptron (P)  Feed Forward (FF)  Radial Basis Network (RBF)

Recurrent Neural Network (RNN)  Long / Short Term Memory (LSTM)  Gated Recurrent Unit (GRU)

Auto Encoder (AE)  Variational AE (VAE)  Denoising AE (DAE)

Deep Feed Forward (DFF)  Deep Convolutional Network (DCN)  Deconvolutional Network (DN)

Generative Adversarial Network (GAN)  Liquid State Machine (LSM)  Extreme Learning Machine (ELM)

Echo State Network (ESN)  Deep Residual Network (DRN)  Kohonen Network (KN)

Support Vector Machine (SVM)  Deep Belief Network (DBN)  Neural Turing Machine (NTM)
Modern Architectures of Deep Learning

ANN

Decision Making

RNN

Sequential Information Processing

CNN

Image Processing

Images credits:
AI is transforming every field, including ours!