Deep learning for agronomy

3rd year engineer

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Avant propos

Deep learning for agronomy involves applying advanced machine learning techniques, particularly deep neural networks, to solve agricultural problems and improve crop production, pest management, and other aspects of agriculture. Below, I'll outline a curriculum for a deep learning course tailored to agronomy. Keep in mind that the field of deep learning and agronomy is evolving, so you may need to adapt this curriculum to stay up to date with the latest developments.

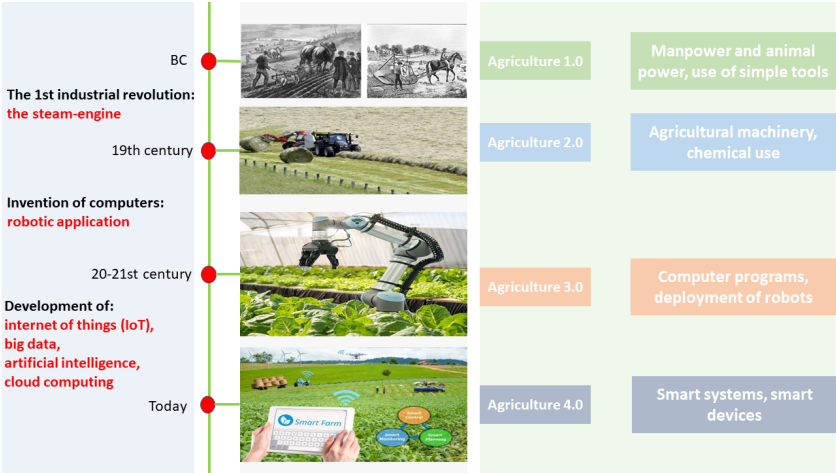## Plan

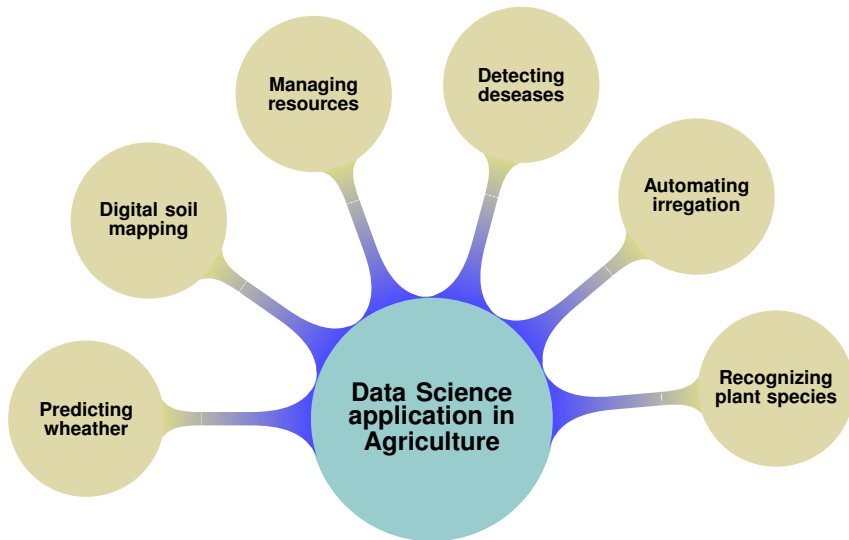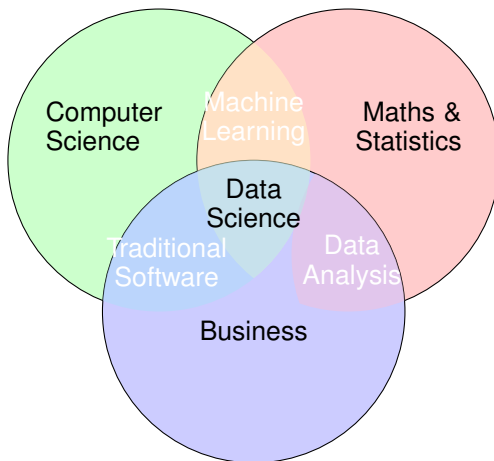1. Introduction to Agronomy and Deep Learning

Overview of Agronomy

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Data science

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Basics To AI, ML And DL
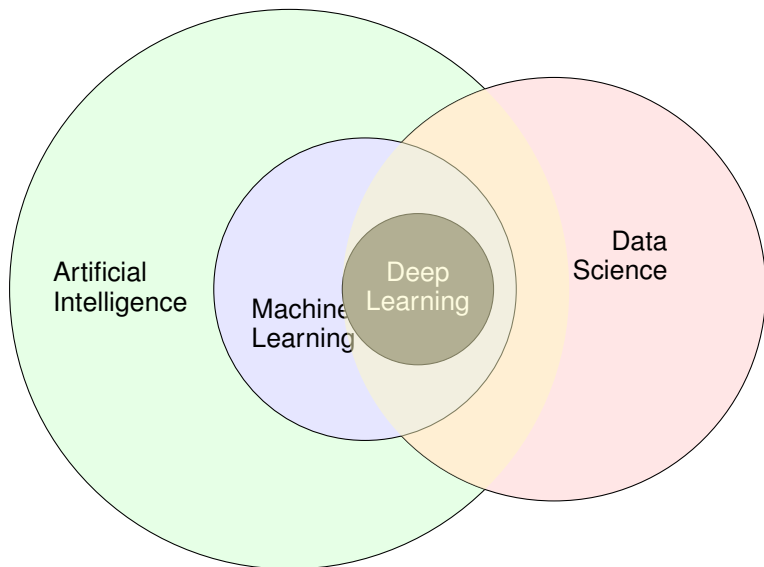
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Basics To AI, ML And DL

Artificial Intelligence

It refers to the simulation of human intelligence in machines that are programmed to think and learn like humans.
AI encompasses a wide range of technologies and techniques that enable machines to perform tasks that typically require human intelligence.
These tasks include :

- problem-solving
- decision-making
- natural language understanding
- speech recognition
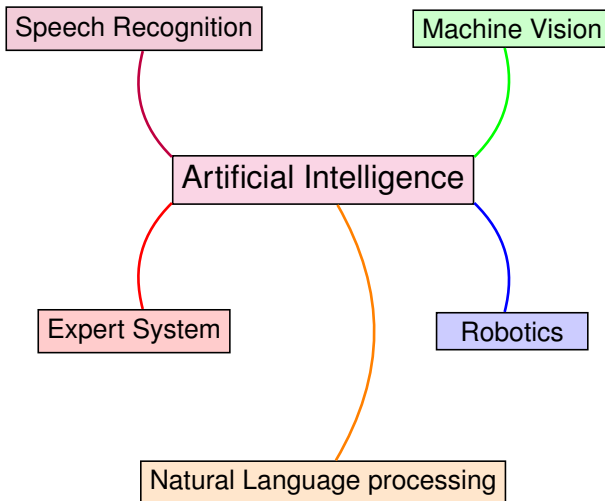- visual perception ...

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Basics To AI, ML And DL

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Basics To AI, ML And DL

Machine Learning (ML)

- Machine learning (ML) represents a branch of artificial intelligence (AI) wherein software applications can make precise predictions without requiring intricate programming. The majority of ML algorithms employ historical data to forecast novel output values.

- In essence, ML can be considered a component of AI, meaning that all ML algorithms fall within the broader field of AI.

- ML empowers machines to autonomously glean insights from data, enhance performance based on prior experiences, and make predictive assessments. ML encompasses a collection of algorithms that operate on extensive datasets. These algorithms utilize the data for training, model creation, and generating fresh predictions using the established model.

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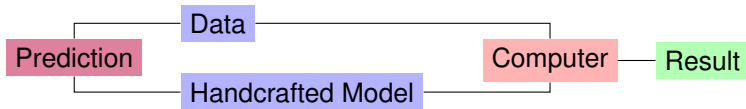## Machine Learning vs. Traditional modeling
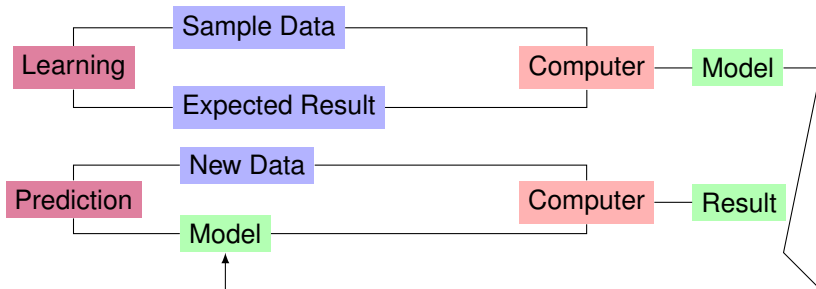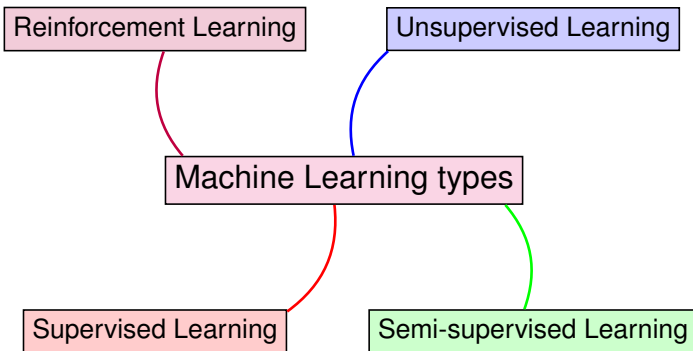

Figura 2: Traditional modeling

Figura 3: ML modeling

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Machine Learning types

Supervised Learning

- Training data is labeled, where inputs are paired with correct outputs
- Infers a mapping function from the inputs to outputs
- **Examples**: image classification, stock price predictions

Unsupervised Learning

- Analyze and cluster unlabeled datasets
- Discover patterns or data categorization without the need for human intervention
- **Examples**: DNA clustering, anomaly detection

Reinforcement Learning

- Agents learn the optimal behaviors to obtain maximum reward through interactions with the environment and observations of how they responds.

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Topics

Models

- Linear regression, regularized approaches (ridge, LASSO)
- Linear classifiers: logistic regression
- Non-linear models: decision trees
- Nearest neighbors, clustering
- Recommender systems
- Deep learning

Algorithms

- Gradient descent
- Boosting
- K-means

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Topics

Concepts

- Point estimation, MLE
- Loss functions, bias-variance tradeoff, cross-validation
- Sparsity, overfitting / underfitting, model selection
- Decision boundaries
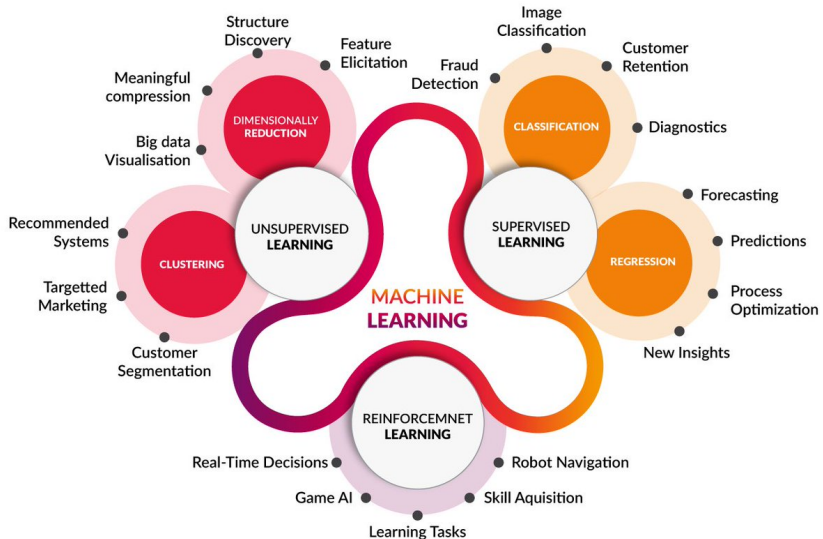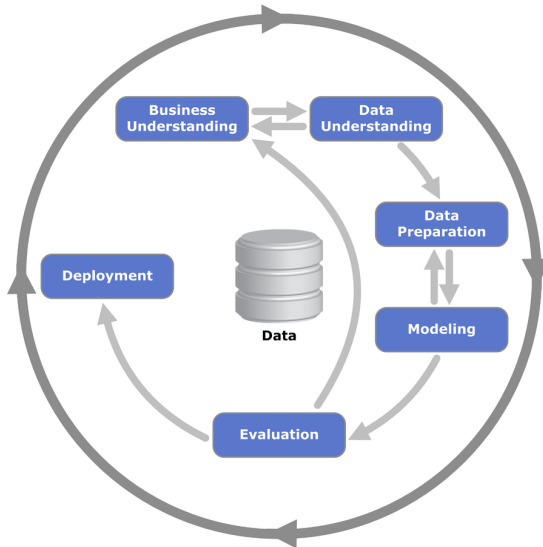
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Figura 4: Kinds of learning

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CRISP-DM

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ML Pipline
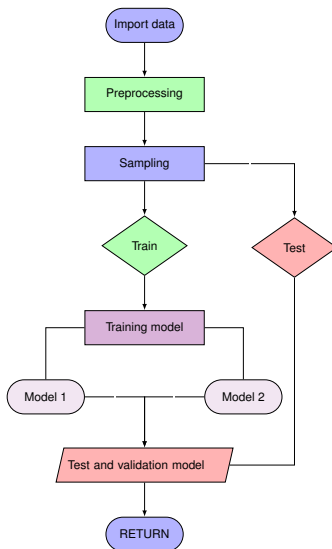
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Figura 6: Scikit-Learn

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Machine Learning	Supervised	Neural Networks
	Unsupervised	
	Reinforcement	
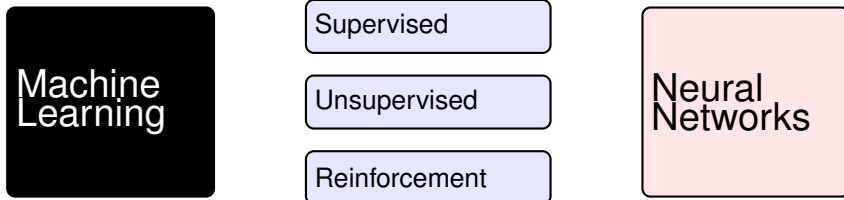
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Basics To AI, ML And DL

Deep Learning (DL)

- Deep Learning (DL) constitutes a subset of Machine Learning (ML) that takes inspiration from the functioning of the human brain. Specifically, the term "Deep Learning" typically refers to the utilization of Deep Artificial Neural Networks.

- Artificial Neural Networks (ANNs) are representations of the neural networks found in the human brain. ANNs are primarily associated with deep learning algorithms and aim to replicate the cognitive processes of the human brain. ANNs can be applied across a spectrum of ML algorithms due to their versatile functionality.

- Consequently, DL effectively instructs computers to perform tasks that humans naturally excel at, such as learning through example. DL employs Neural Networks (NNs) to extract higher-level information. These NNs consist of three layers: the input layer, the hidden layer, and the output layer. Each successive layer employs the output of the preceding one as its input. For instance, in optical character recognition, lower layers identify edges, while higher layers recognize letters.

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