

# Low code AI with MATLAB

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# Example application: Battelle Neural Bypass Technology Restores Movement to a Paralyzed Man's Arm and Hand

## Challenge

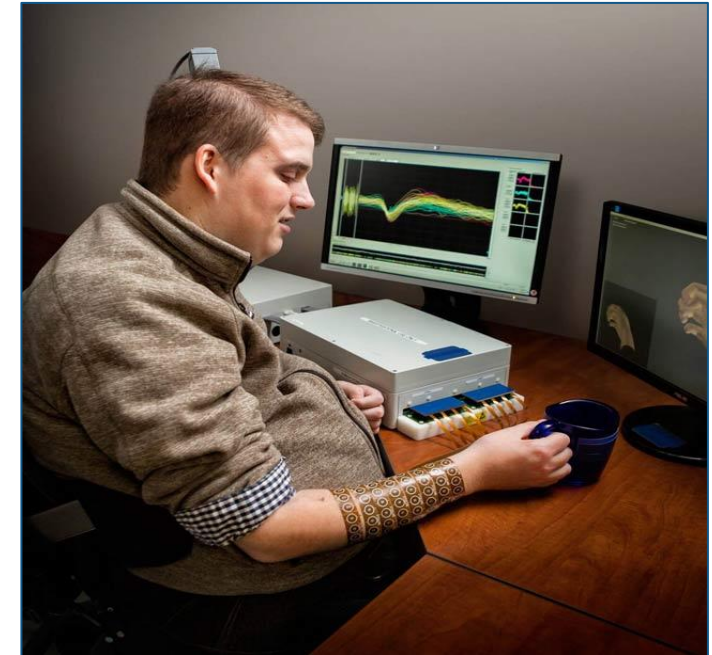
Restore arm and hand control to a quadriplegic man by processing signals from an electrode array implanted in his brain

## Solution

Use MATLAB to analyze signal samples, apply machine learning to classify patterns mapped to movements, and generate actuation signals for a neuromuscular electrical stimulator

## Results

- Control over paralyzed hand and arm restored
- Real-time processing performance achieved
- Interdisciplinary collaboration enabled



Patient using the Battelle NeuroLife system.

*"The algorithms we developed using MATLAB gave the participant back basic control of his arm and hand. By the end of the study, he could grip a bottle, pour out its contents, and set it down, as well as pick up a stir stick and execute a stirring motion."*

*- David Friedenberg, Battelle*

# Some Basic Definitions

**Artificial Intelligence**

**Machine Learning**

**Deep Learning**

# Some Basic Definitions

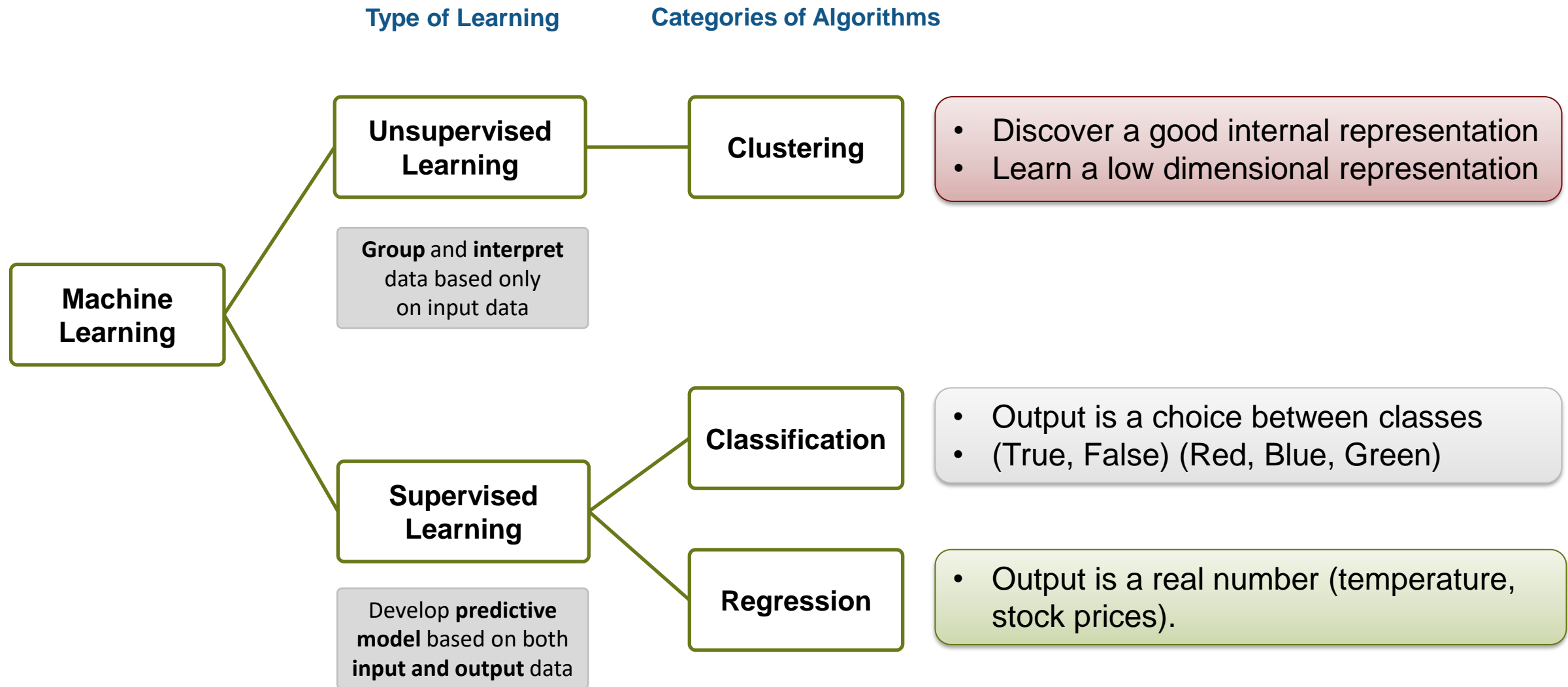
## Artificial Intelligence

The ability of

## Machine Learning

The practice of **learning a task from data**  
**without** relying on a predetermined equation or model

# Different Types of Machine Learning



# Some Basic Definitions

## Artificial Intelligence

### Machine Learning

#### Deep Learning

A **type** of machine learning  
in which a model learns to perform tasks  
**directly from images, text, or sound**

# Machine learning and AI are math intensive!

## Some heavily used topics in machine learning and deep learning

- Linear algebra
- Calculus
- Probability and Statistics
- Discrete mathematics
- Optimization

# Machine/Deep Learning Workflow

Access and Explore Data

Preprocess Data

Develop Predictive Models

Integrate Analytics with Systems

Files



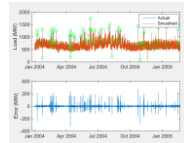
Databases



Sensors



Working with Messy Data



Data Reduction/Transformation



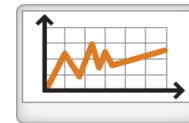
Feature Extraction



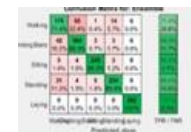
Model Creation e.g. Machine Learning



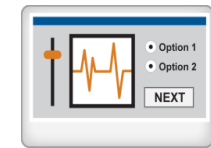
Parameter Optimization



Model Validation



Desktop Apps



Enterprise Scale Systems

MATLAB Excel  
.NET C/C++  
.exe Java .dll

Embedded Devices and Hardware





# Resources

# Primary and Secondary School License

Creating a foundation for a future in STEM

## Deep Learning Onramp

Get started with deep learning techniques in MATLAB for recognition.

[Details](#)

### [Machine-Learning-Methods-Clustering](#)

Public

Interactive courseware module that addresses the theory behind multiple clustering methods and how to apply them to real data sets.

 MATLAB  5

### [deep-learning-for-image-processing](#)

Public

Teaching and learning deep learning in the context of digital image processing

 7  3  1  0 Updated on Sep 29, 2023

### [Applied-Linear-Algebra](#)

Public

A collection of teaching scripts showing applications of linear algebra to chemistry, computer science, mechanical engineering, and more.

 MATLAB  12  BSD-3-Clause  3  0  0 Updated on Apr 30

Thank you!