

Project 9

Aurora

Jacob

Omar

Table of Contents

- Introduction
- Objectives
- Historical
- Artificial Intelligence
- Data Gathering
- Technical
- Responsibilities
- Timeline



Lewis Skolnick, pre-B.sc.

Introduction

1. Research

a. Artificial Intelligence

i. Machine Learning

ii. Deep Learning

b. Evolutionary Computation

i. Reducing search space

ii. Modeling evolution using various techniques

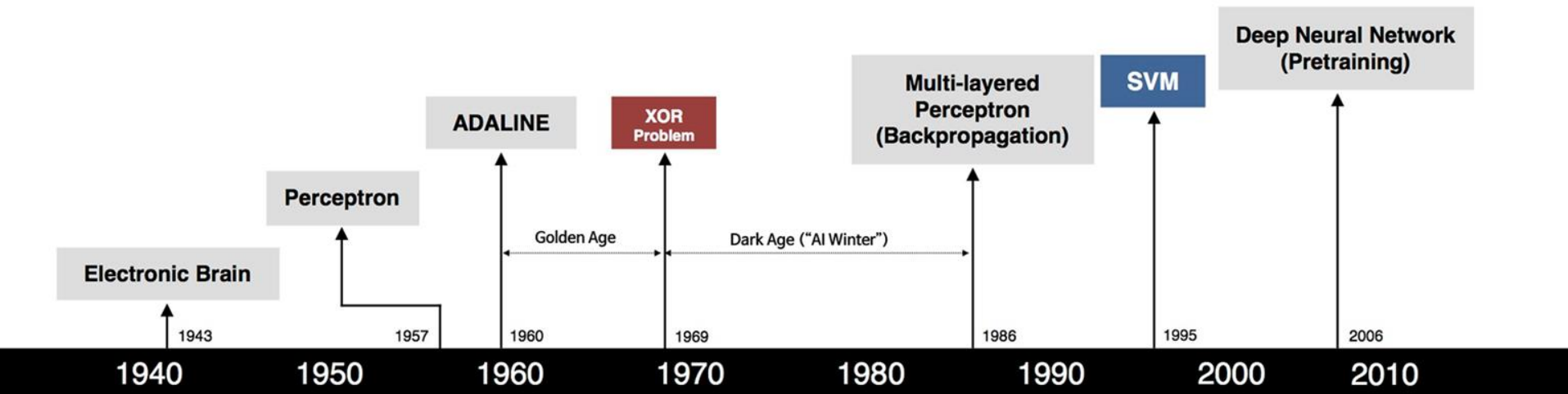
2. Application

a. Use of UWB sensor

Objectives & Approaches

- The research and study of
 - Genetic Algorithms(GA) + Artificial Neural Networks (ANN)
 - Data collection and application of GA and ANN
 - The gathering of result
 - Formalize findings

Historical



S. McCulloch - W. Pitts



F. Rosenblatt



B. Widrow - M. Hoff



M. Minsky - S. Papert



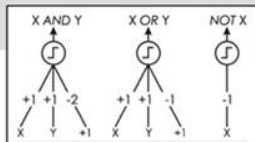
D. Rumelhart - G. Hinton - R. Williams



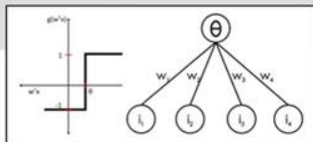
V. Vapnik - C. Cortes



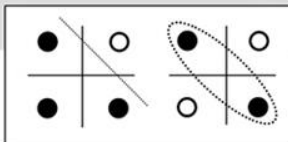
G. Hinton - S. Ruslan



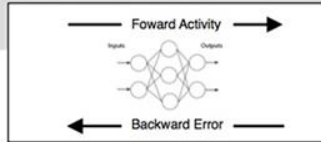
- Adjustable Weights
- Weights are not Learned



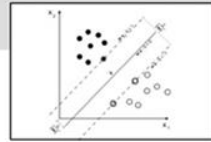
- Learnable Weights and Threshold



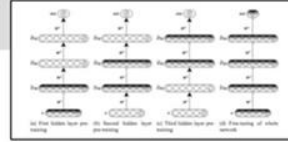
- XOR Problem



- Solution to nonlinearly separable problems
- Big computation, local optima and overfitting

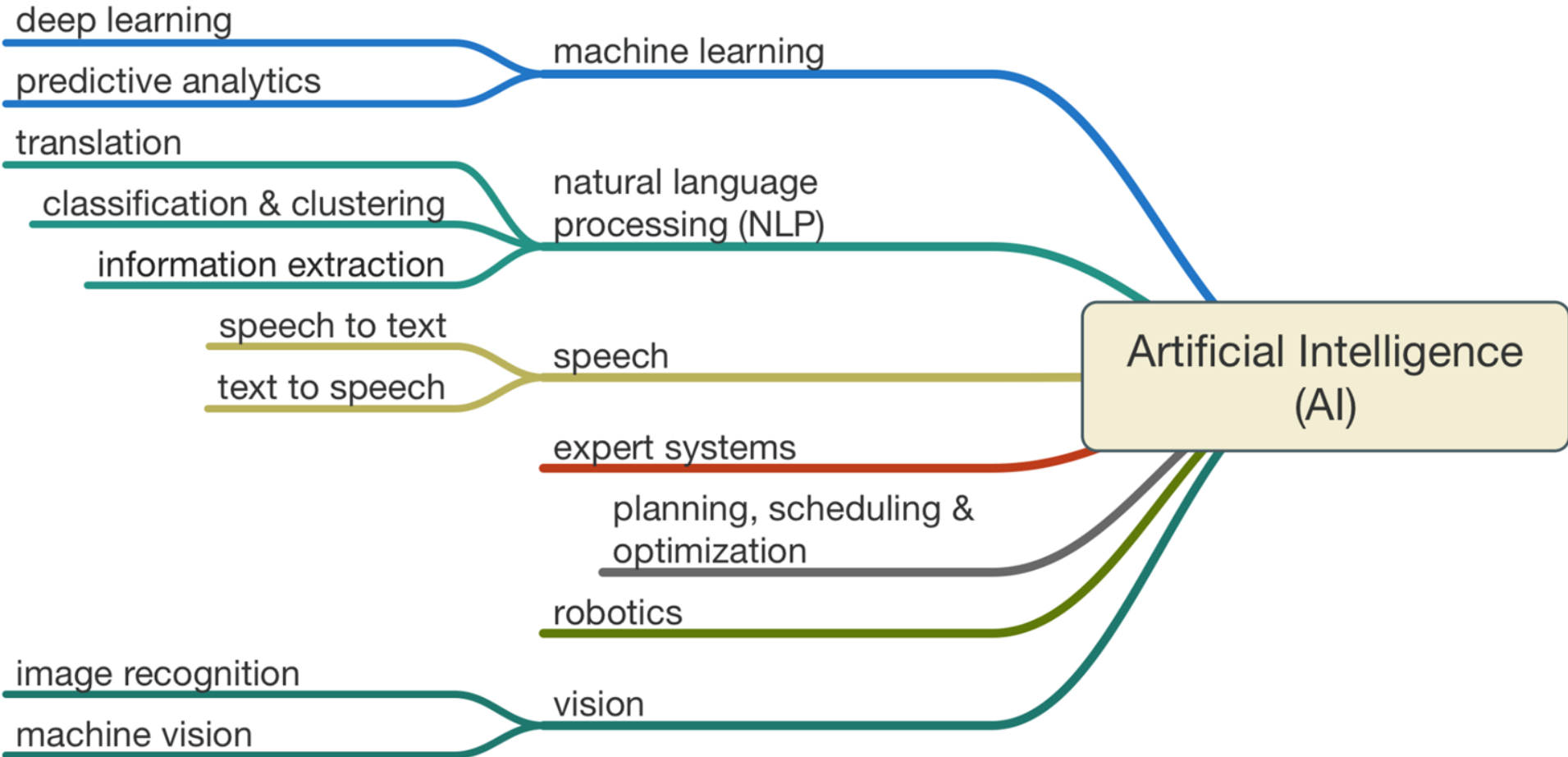


- Limitations of learning prior knowledge
- Kernel function: Human Intervention



- Hierarchical feature Learning

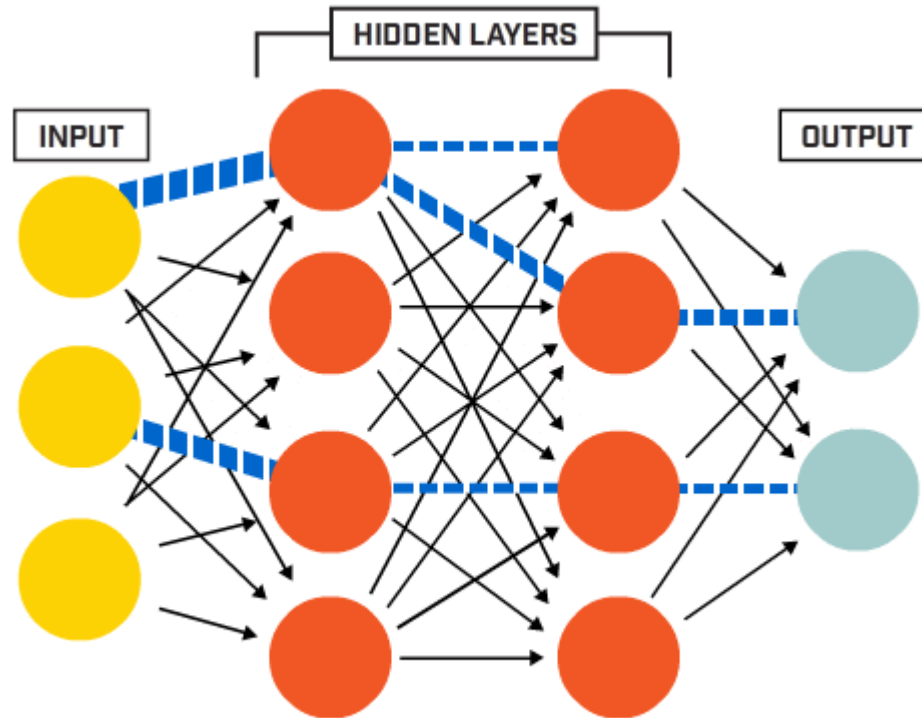
Artificial Intelligence (AI)



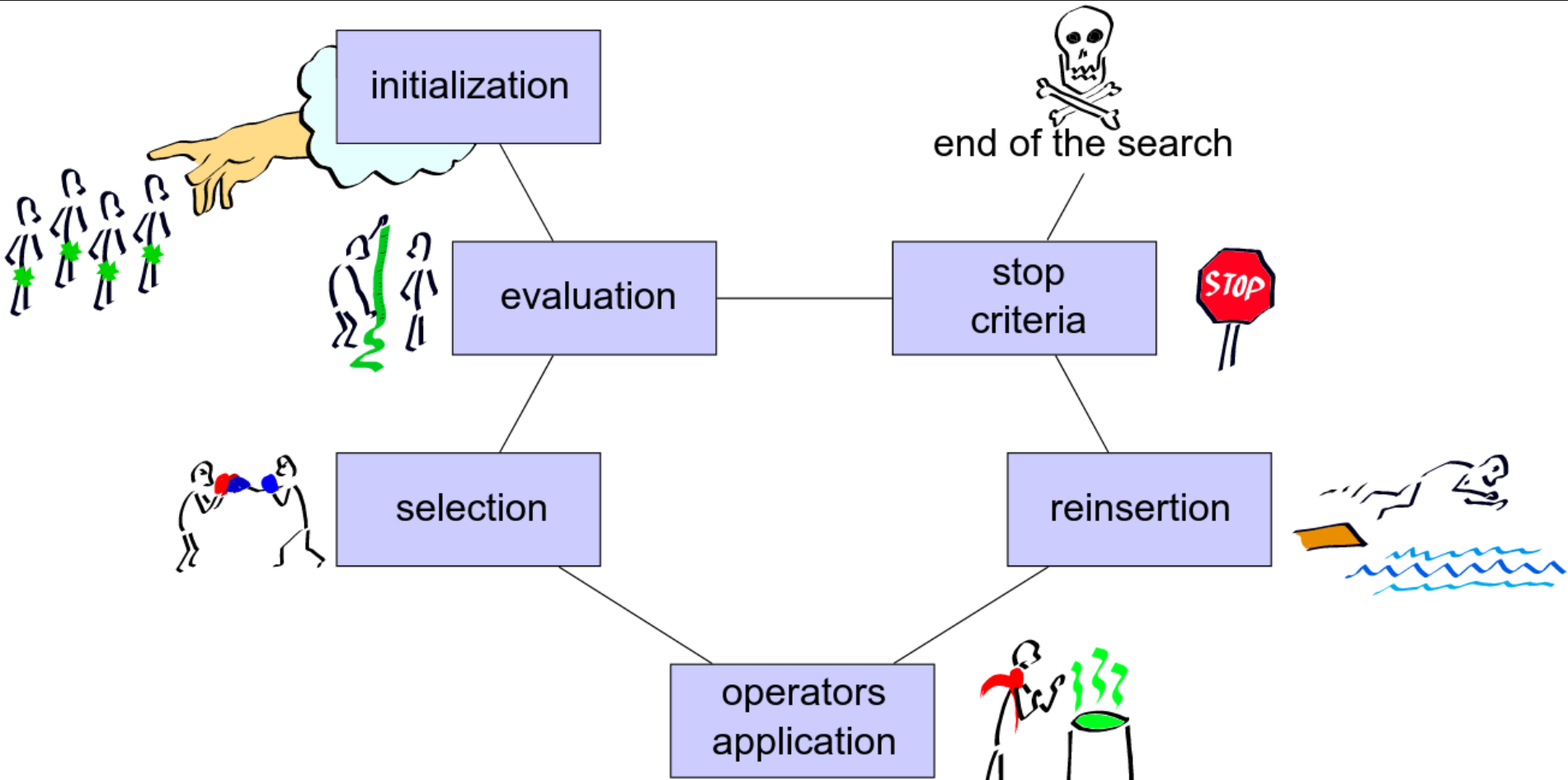
Neural Network (NN)

- Proposed in the 1940's
- Human vs machine
 - Neurons
 - Learning by example: “learning by doing”
- Learning paradigm
 - Supervised vs unsupervised

Neural Network (NN)



Genetic Algorithm (GA)



Data and Gathering

- Setup experiments with sensor
- Collect experiment data to be used
- Record and format data into the appropriate format
 - Add meta-data (e.g., people in the room) to be used for prediction by NN

Technical

- Debian 10 (Linux 4.12+)
- NetBeans 8.2
- GCC toolkit 7.2 (Supports latest C++17 standard)
- XeThru USB UWB Sensor + SDK
- Bitbucket.org - source control management

Responsibilities

All responsibilities are common between all team members, this includes:

- Data Gathering
- Analysis
- Interpretation
- Tool & Framework Construction
- Data Modeling & Encoding
- Performance Analysis
- Performance enhancement
- Testing
- Gathering results

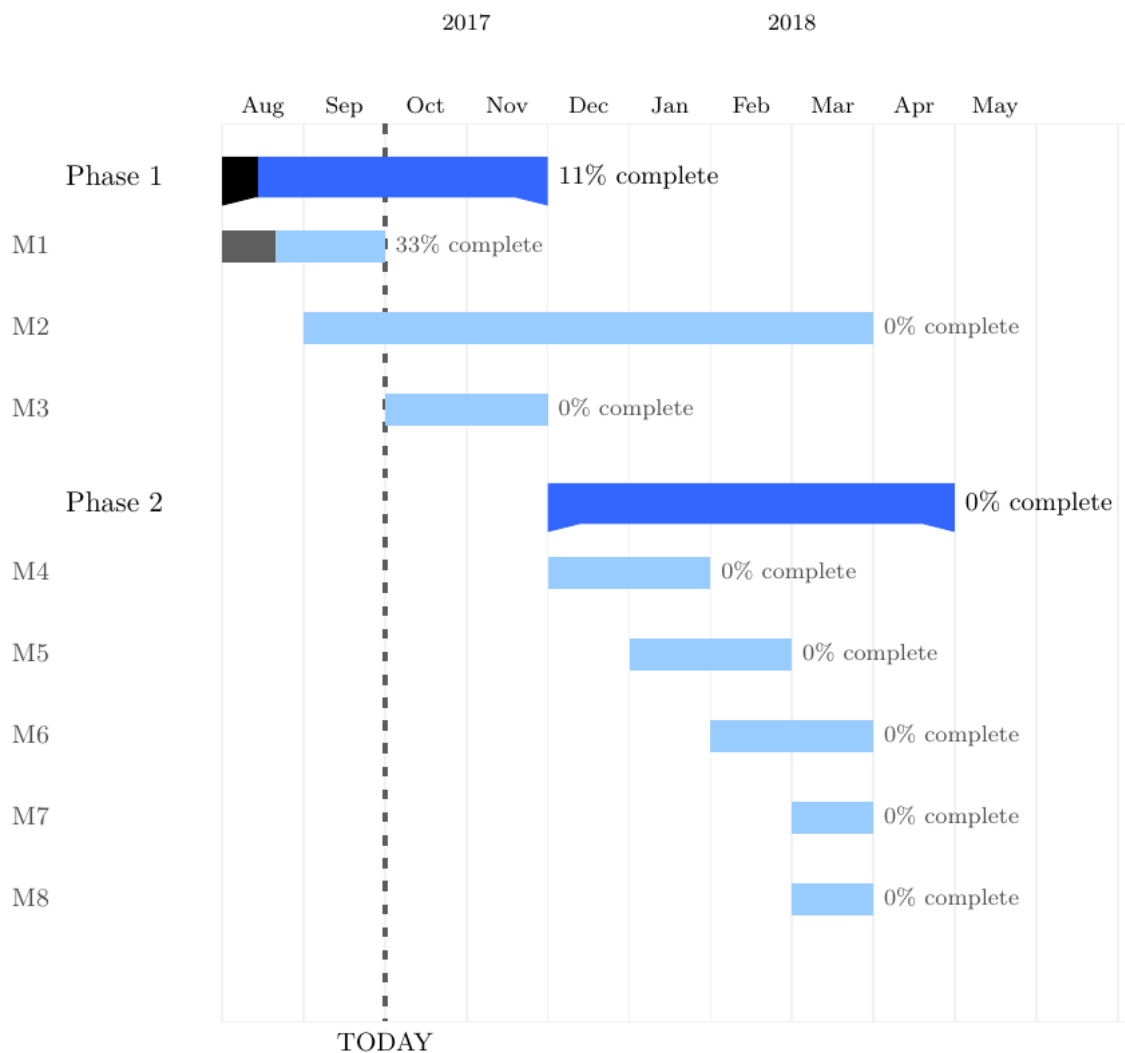
Project Timeline

- **Phase I**

- **M 1: Data Gathering, Analysis & Interpret.**
- **M 2: Tool & Framework Construction**
- **M 3: Data Modeling & Encoding**
- **M 4: Performance Analysis**

- **Phase II**

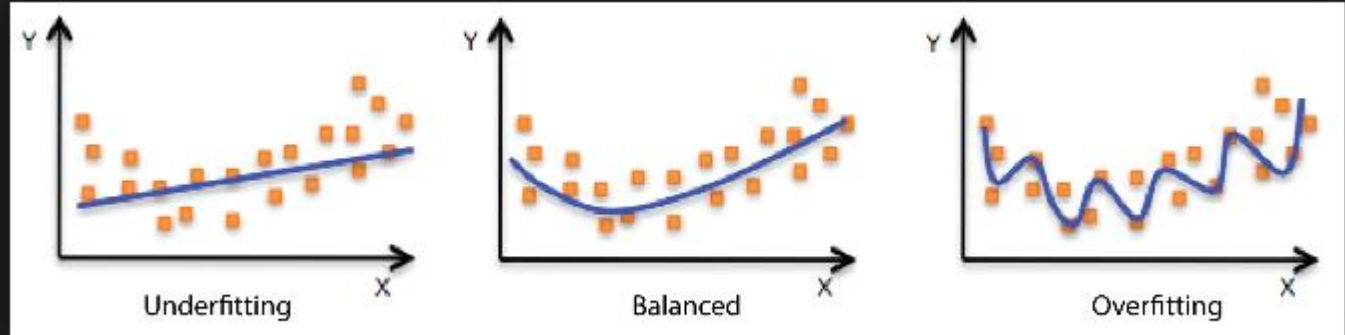
- **M 5: Performance Enhancement**



Anticipating Obstacles

http://docs.aws.amazon.com/machine-learning/latest/dg/images/mlconcepts_image5.png

- Extracting features from data
- Optimizing performance of GA/NN
- Time limitations
- Underfitting
- Overfitting



Hopes and Aspirations

- Present a method of detecting the number of occupants in a room with reasonable accuracy
- Further exploit methodology to expand it

Questions!

Ask us about...

Ask one, ask all...

References

Figure A: <http://qingkaikong.blogspot.com/2016/11/machine-learning-3-artificial-neural.html>

Figure B: <https://media.licdn.com/mpr/mpr/AAEAAQAAAAAAAAAd5AAAAJDkxYWVViYWl1LTY1NjYtNDA0Yy04ZWY3LWE1OTViNjkzMDliZg.png>

Figure C: https://upload.wikimedia.org/wikipedia/commons/3/3c/Evolutionary_Algorithm.svg

Figure D: <https://impekable.com/wp-content/uploads/2017/07/deep-learning-weight-paths.gif>

Figure E: http://docs.aws.amazon.com/machine-learning/latest/dg/images/mlconcepts_image5.png