MACHINE LEARNING BASICS

認識機器學習

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# OVERVIEW & PURPOSE

這是一門不從理論講解推導入手機器學習（ Machine Learning）的簡易課程，目標在以各式的實作讓學員理解機器學習可以幫助我們做什麼，以及機器學習的限制在哪邊。實作以簡單的影像處理開始，然後進入打遊戲，最後是應用自走車在各式不同的情境下如何用機器學習來解決問題。課程採用專案式學習 ( Project Based Learning)為主軸，從資料分析，前處理，規則式（Rule Based）解決方案一直到納入機器學習工具。刻意不用AI（人工智慧）這個名詞來為這個課程定名是不希望學員被各式迷思混淆，而是回到學習的本質。

# OBJECTIVES

1. 確認學員了解機器學習演算法的基本概念
2. 以實作代替過多的講解
3. 確認學員認知資料分析與前處理對機器學習的重要性
4. 確認學員了解資料前處理之後的排列方式與意義
5. 確認學員能夠使用Python上的機器學習工具並完成所有的作業

# PREREQUISITE

1. Basic Python programming skill
2. Basic understanding of array and matrix
3. Basic understanding of algebra and math

# MATERIALS NEEDED

1. 筆記型電腦
   1. 規格

OS : win7(含)以上

CPU : i5-4460(含)以上

RAM : 8G

1. 課前軟體安裝
   1. 7697 Arduino
   2. Anaconda
   3. 請見附件A and B
   4. Gimp
2. 7697自走車
   1. 須先行組裝並能夠行走，1/31會安排簡易的改裝
   2. 請先搭起一個小的迷宮，3x3即可。
   3. 請先測試藍芽與Wifi功能
   4. 如果可能，請先安裝測試PLX\_DAQ功能
      1. https://goo.gl/tdjFam

# SYLLABUS

1. Introduction to Machine Learning
   1. Work flow of machine learning
   2. Data space and feature space
   3. Preprocessings
2. K-Mean
   1. Example clustering and test drive of sklearn
   2. Image representation
   3. Quantization in different color spaces
   4. Comparisons of different color spaces and data rearrangement
3. SVM
   1. Basics of SVM/SVR
   2. Kernel SVM
   3. SVM for Multi-class classification
   4. Image Processing examples
      * 美圖秀秀與照片調色應用
      * 請在自己的電腦安裝Gimp，使用裡面的調色盤功能。
      * 如何用SVM作出你想要的美肌
      * Comparisons of different color spaces and data rearrangement
   5. Wall configuration decision of self-driving cars using 3 supersonic sensors. No need to be 7697 based cars.
   6. Test of SVM classification using 7697 self-driving car
      * Data acquisition using PLX\_DAQ
4. NN
   1. Basics
   2. Image application examples
      * Image color transformation
      * 請在自己的電腦安裝Gimp，使用裡面的調色盤功能。
      * 美圖秀秀與照片調色應用
      * 如何用NN作出你想要的美肌
      * Comparisons of different color spaces and data rearrangement
   3. Wall configuration decision of self-driving cars using 3 supersonic sensors. No need to be 7697 based cars.
5. 7697自走車
   1. Installation of maze positioning system(MPS)
   2. How to send and receive data with MPS server
   3. Test drive

# VERIFICATION

*Steps to check for student understanding*

*Know the limitation of different machine learning tools.*

1. K-Mean
   1. Know how to arrange a desired data representation
   2. Know the difference of the number of clusters
2. SVM
   1. Know how to acquire data
   2. Know how to annotate data
   3. Know how to use SVM for direction finding of his/her self-driving car
   4. Know how to port it to his/her 7697 self-driving car
3. NN
   1. Know basics of color spaces
   2. Know basics of color operation/transformation of images
   3. Know how to use the tools to imitate the transformations
   4. Know how to use NN for direction finding of his/her self-driving car
4. 7697自走車
   1. Know how to set up MPS
   2. Know how to get position information from MPS
   3. Know how to send/receive data from MPS
   4. Know how to report MPS bugs

# APPENDIX.A Python環境安裝指南 <https://goo.gl/mvycFp>

# APPENDIX.B Arduino環境安裝指南 <https://goo.gl/hhgJQX>

# APPENDIX.C 課程投影片

# APPENDIX.D 7697自走車範例程式碼 <https://goo.gl/HUy8PU>

# REFERENCE.A 7697自走車相關資料 <https://goo.gl/R1oWXe>