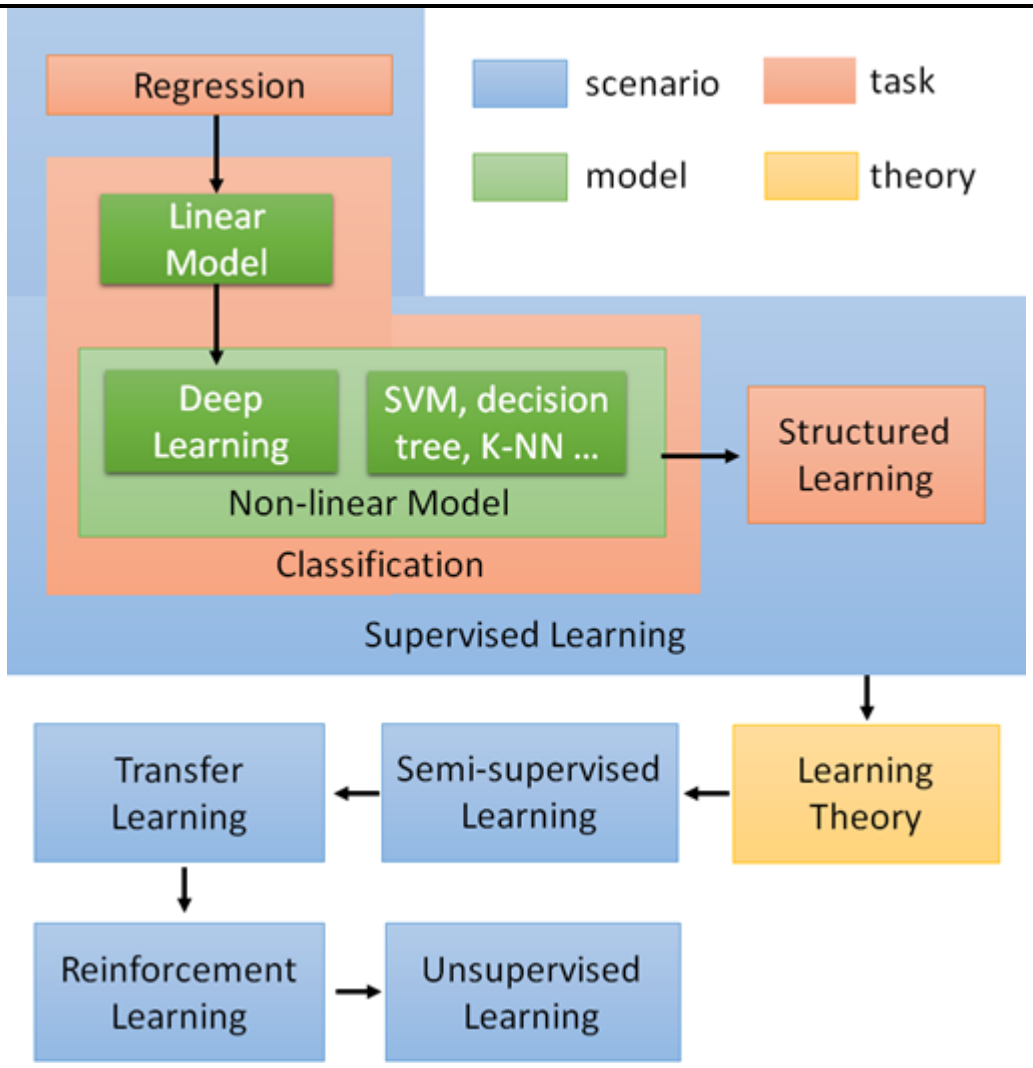
Course Content	
Course Title (English)	Machine Learning
Course Title (Chinese)	機器學習
Credit	3
Instructor	Prof. Hung-yi Lee 李宏毅 教授
Outline	你可能已經修過和計算機程式相關的課程，能夠設計程式讓電腦處理一些簡單的問題，但是你有沒有想過，那些處理非常複雜問題的程式是如何設計出來的呢？例如：Gmail 如何知道一封郵件是否為垃圾郵件？Facebook 如何知道一張相片是否包含人臉？ Siri 如何聽懂並回答使用者的問題？人類製作出來的 Alpha Go 為什麼可以比職業棋士還強呢？事實上，這些程式中的演算法並非由人類直接設計，而是由人類寫出讓機器能夠根據資料學習的演算法後，讓機器自動由大量的資料、過去的經驗找出可以處理這些問題的方法，例如：如果我們想讓機器能夠偵測一封郵件是否為垃圾郵件，我們可以讓機器「看過」大量的郵件，並「告知」機器哪些郵件是垃圾郵件、哪些不是，機器便可以利用這些資訊自動去建構出偵測垃圾郵件的模型，當收到新的郵件時，機器便根據所學的模型去偵測它是否為垃圾郵件，而如何設計出讓機器自動學習的演算法就是「機器學習」這個領域在探討的問題。 課程主要內容如下:



上課方式:

1. 老師以投影片上課，另有助教時間由助教講授作業以及期末專題。

2. 作業：作業共七個，由個人獨立完成。每個作業包含實作和理論兩部分，實作部分需繳交程式碼由助教驗證成果，理論部分需繳交報告並回答指定的問題。

七次作業涵蓋主題如下(實際作業內容以上課公告為準)：

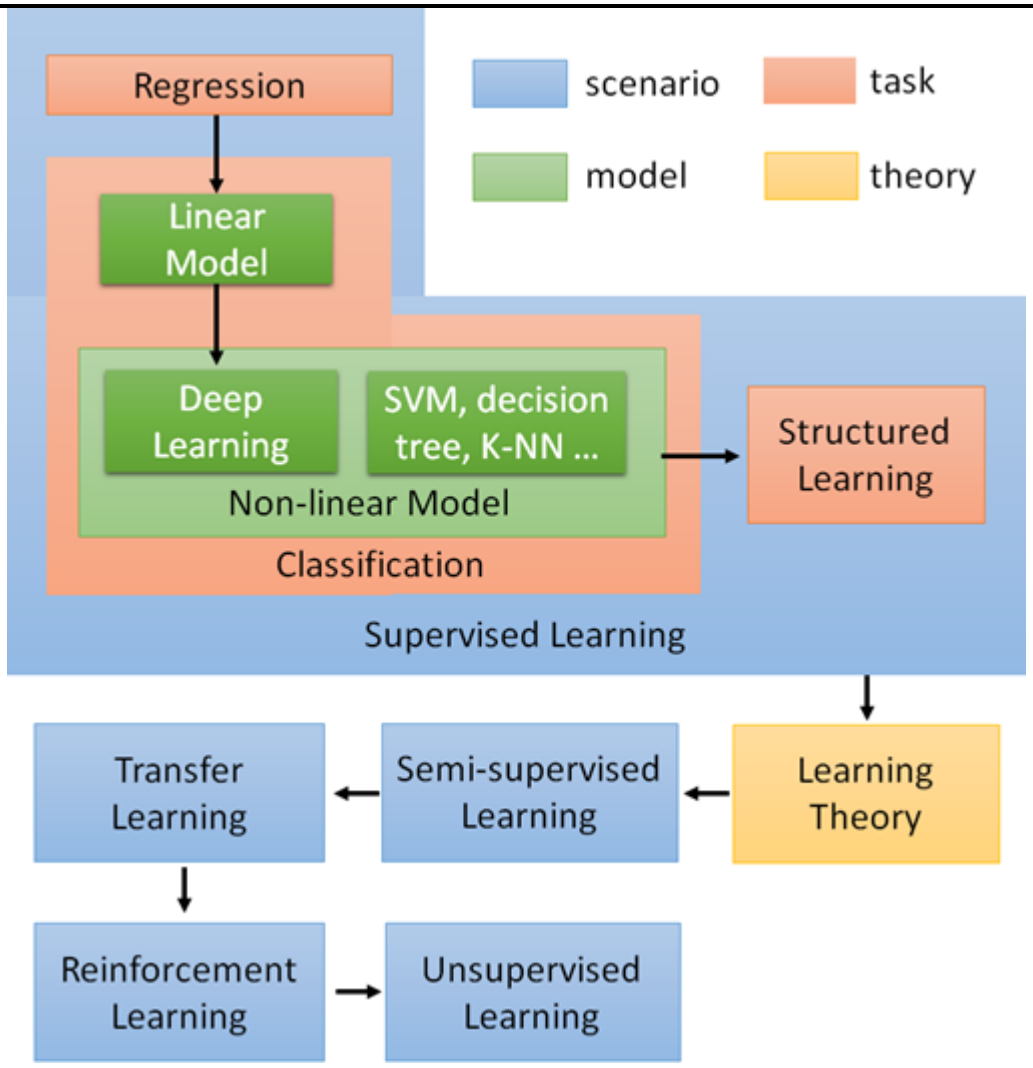
----- Regression

----- Binary Classification

----- Multi-class classification

----- Multi-class classification (can only be solved by non-linear model, e.g. deep learning)

	----- Sequence labeling (It is easier to solve this problem by structured learning approaches) ----- Semi-supervised Learning ----- Unsupervised Learning 3. 期末專題：二到四人一組，找不到隊友也沒關係，老師可以幫忙配對。老師會準備數個實際的機器學習競賽題目，這些題目都非常具有挑戰性，需要使用多種機器學習技術才能完成，學生可以從中選取一個題目完成。 You may have taken courses related to computer programming and can write programs to handle some simple tasks. But have you ever wondered how to design the programs that can deal with very complex tasks? For example, how does Gmail know if an email is a spam? How does Facebook know if a photo contains a human face? How does Siri understand and answer user questions? Why is Alpha Go made by humans better than professional chess players? Humans do not directly design the algorithms in these programs. Instead, humans write algorithms that allow machines to learn from data. For example, if we want a machine to detect whether an email is a spam or not, we can let it "read" many emails and "tell" it which emails are spam and which are not. Then the machine can automatically construct a model for detecting spam. When a new email is received, the machine will identify whether it is spam based on the learned model. Designing an algorithm for the machine to learn automatically is the basic idea of "machine learning." The content of the course is as below:



The way of classes:

1. The teacher will use the slides to teach the class, and the teaching assistant will teach homework and final topics.

2. Homework: There are seven assignments. Each assignment consists of two parts: implementation and theory. The implementation part needs to submit the code to verify the results by the teaching assistant, and the theory part needs to submit a report and answer the specified questions.

The topics covered by the seven assignments are as follows:

----- Regression

----- Binary Classification

----- Multi-class classification

	----- Multi-class classification (can only be solved by non-linear model, e.g., deep learning) ----- Sequence labeling (It is easier to solve this problem by structured learning approaches) ----- Semi-supervised Learning ----- Unsupervised Learning 3. Final topic: A group of two to four people. The teacher will prepare several real-world machine learning tasks. These tasks are very challenging and require the use of a variety of machine learning techniques to complete. Students can choose one of them to complete.
Goal	本課程旨在介紹機器學習使用者都應該知道的基本機器學習理論、方法和工具，希望透過這門課學生對機器學習的技術可以有系統性的認識，並具備實作這些技術的基本能力，以期在未來能將這些技術活用到各自的專業領域中。 This course aims to introduce the fundamental machine learning theories, methods, and tools that all users of machine learning should know. Through this course, students can have a systematic understanding of machine learning technologies and have the ability to implement these technologies.
English Teaching	☐ YES ■ NO
Teaching Material	■ English ☐ Chinese