



[SWCON253] Machine Learning – Lec.00

# Course Orientation

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Fall 2025

김휘용



Visual Media Lab

<http://vmlab.khu.ac.kr>

# ToC

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- 1. About Me**
- 2. About this Course**
- 3. Evaluation**
- 4. Schedule**
- 5. Textbook**

# 1. About Me

## ◆ Previously..

- KAIST 전기및전자공학과 (BS/MS/Ph.D)
  - ★ packet scheduling, visual surveillance, object segmentation/coding
- AddPac Technology 멀티미디어팀 (2.3y)
  - ★ video gateway, video phone, video conference, DVR
- ETRI 실감AV연구그룹 (14y)
  - ★ multimedia systems/formats, video coding, realistic video processing
- 숙명여자대학교 전자공학전공 (0.5y)

## ◆ Currently..

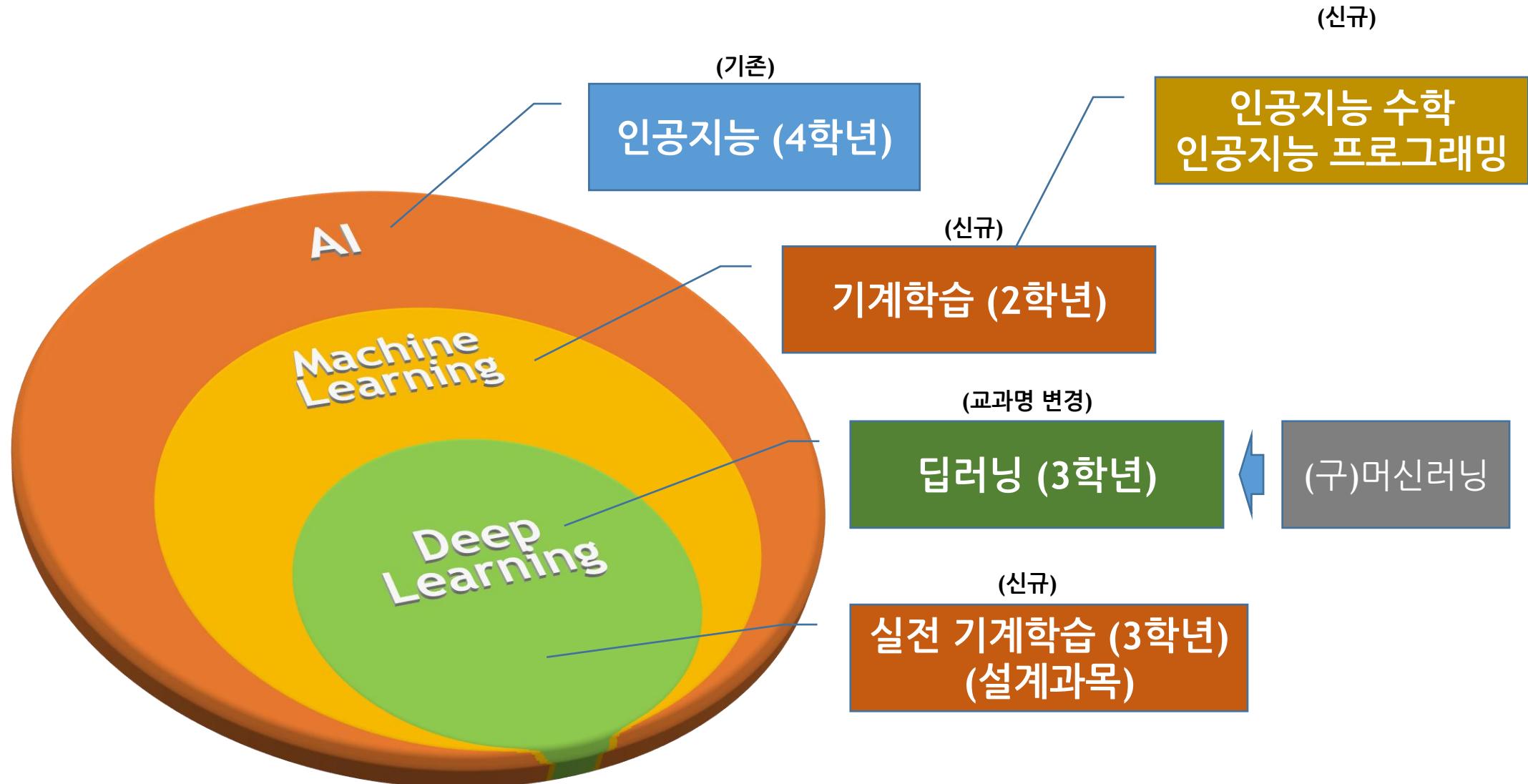
- 경희대학교 컴퓨터공학부 (2020~)
- Visual Media Lab.
  - ★ *Realistic Media* – UHD, Hologram, ...
  - ★ *Intelligent Media* – Machine Learning, Visual Understanding
  - ★ *Video Coding & International Standardization*
  - ★ <https://vmlab.khu.ac.kr/>



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 경희대학교 KYUNG HEE UNIVERSITY	컴퓨터공학과/영상미디어연구실
	▪ 김 휘 용 (金暉容, Hui Yong Kim) ▪ 경희대학교 컴퓨터공학과 부교수 ▪ hykim.v AT gmail.com ▪ Tel. 031-201-3760 ▪ Rm. 국제캠퍼스 전자정보대학관 448
Education (학력)	
Work Experience (경력)	
Awards (수상)	
Community Service (대외 활동)	
Standard Essential Patents & Technology Transf	
International Publication (국제논문)(Last 5 year:	
International Standard Contributions (국제표준)	
International Patents (국제특허)(Latest 100 only)	
Domestic Patents (국내특허)(Latest 100 only)	

## 2. About this Course – AI / ML / DL



## 2. About this Course

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### ◆ Objectives

- 기계학습 및 딥러닝을 위한 **기초 수학**의 확립
  - ★ 선형대수, 확률과통계, 정보이론, 최적화
- 다양한 **기계학습 기법**의 이해 및 활용
  - ★ 분류(classification), 회귀(regression), 군집화(clustering), 차원축소(dimensionality reduction), 신경망(neural network) 등 기계학습의 주요 주제에 대한 이론을 학습하고 실습을 통해 확인

### ◆ Textbook

- (주교재: 이론) **기계학습**, 오일석 저, 한빛아카데미 2017
- (주교재: 이론) Coursera "Machine Learning", Andrew Ng, <https://www.coursera.org/learn/machine-learning>
- (부교재: 실습) **Python Machine Learning**, 3/E, Sebastian Raschka, Packt Publishing 2019

### ◆ Pre-requisites

- (필수) 웹/파이썬 프로그래밍
- (필수) 선형대수, 확률및랜덤변수, 미분적분학 : 일부 내용(Review)은 녹화 강의로 제공
- (권장) 인공지능수학, 인공지능프로그래밍

## 2. About this Course – 수업 운영

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### ◆ Logistics

- 화/목 15:00-16:15 (B09)
- 휴강 (잠정)
  - ★ 10/2(목)~10/14(화): 10/2(국외출장), 10/7 & 10/9(추석 & 한글날), 10/14(국외출장)
  - ★ 12/2(화) & 12/4(목): 국외출장
- 보강: 16주차 및 녹화강의 활용

### ◆ E-campus 활용

- "공지"
- "주차학습" – 강의자료(PDF), 과제 공지/제출
- "게시판" – 강의 QnA (담당교수), 과제 QnA (조교)

### ◆ Teaching Assistant (과제 담당)

- 김영웅 ([duddnd7575@khu.ac.kr](mailto:duddnd7575@khu.ac.kr))
- 조수현 ([bloodtypeo@khu.ac.kr](mailto:bloodtypeo@khu.ac.kr))

# 3. Evaluation

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## ◆ 과제 (40%)

- **복습과제 (15%)**: 강의 후 스스로 복습한 내용을 A4용지 **1페이지** 이상 손글씨로 작성/스캔하여 제출 (거의 매주)
- **실습과제 (25%)**: 실습과제에 대해 프로그램(파이썬) 코드 파일(.ipynb & html) 제출 (5~6회)
- 지연제출:
  - ★ 기한 + 1주 이내: 최고점수가 80%
  - ★ 기한 + 1주 초과: 0점

## ◆ 시험 (60%)

- 중간고사 (30%): **(8주차 수업시간)**
- 기말고사 (30%): **(16주차 수업시간)**

## ◆ 출석 (0%)

- No credit, but too much absence will lead to F (school rule).

## ◆ Grading: 상대 평가

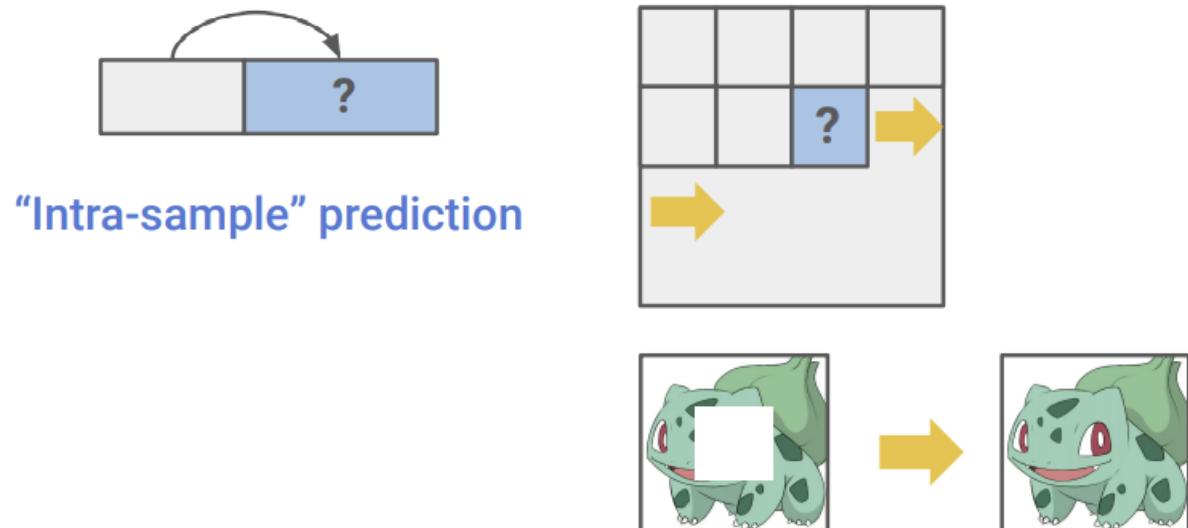
- 등급컷은 점수 분포를 보고 결정할 예정 (**A-이상 45%이내**)

# [참고] How to Learn?

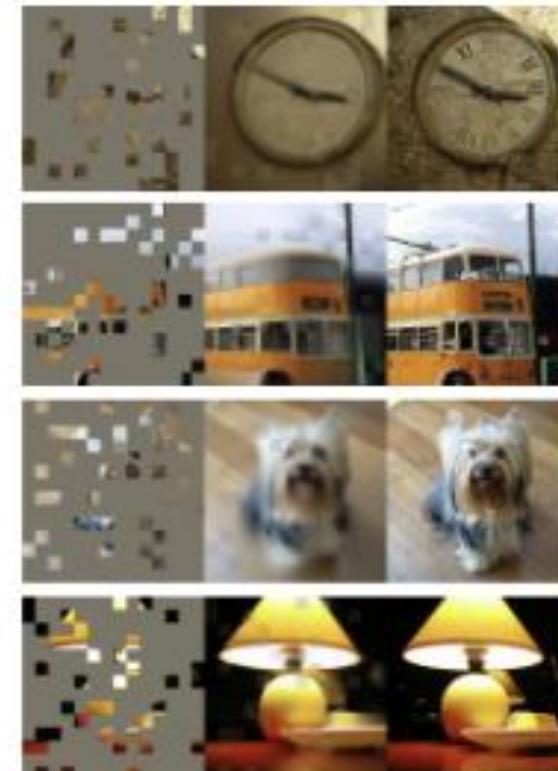
## ◆ Self-supervised Learning (SSL)

### ● Self-prediction (Masking)

- ★ Given an individual data sample, *predict one part* of the sample given the other part.
- ★ The part to be predicted pretends to be missing.



<https://neurips.cc/media/neurips-2021/Slides/21895.pdf>)



He, Kaiming, et al. "Masked autoencoders are scalable vision learners." Proceedings of the IEEE/CVF CVPR 2022

# 4. Schedule (Tentative)

주차	Topics (화)	Topics (목)	+ Self Study
1	L00. Orientation	L01. Intro to ML	L02 녹화강의 청취
2	L02. Linear Algebra (Review)	L03. ML Toy Example	L04 녹화강의 청취
3	L04. Vector Calculus (Review)	L05. Gradient Descent	
4	L06. Linear & Polynomial Regression [P1]	L07. Logistic Regression [P1]	
5	L08. Perceptron & Decision Boundary [P2]	==	
6	L09. Neural Networks - MLP [P3]	==	
7	L10. Overfitting & Regularization	L11. Model Evaluation	
8	L12. Multiclass Classification & Softmax	중간고사 (30%)	
9	L13. Constrained Optimization (Review)	==	L13 녹화강의 청취
10	L14. Support Vector Machine (SVM) - Linear [P4]	==	
11	L15. Support Vector Machine (SVM) - Non-Linear [P4]	==	
12	L16. Clustering with K-Means	L17. Probability & Decision Theory (Review)	L17 녹화강의 청취
13	L18. Density Estimation - Non-parametric	==	
14	L19. Density Estimation - Parametric [P5]	6/6(목) 현충일 휴강	
15	L20. Dimensionality Reduction - PCA [P6]	==	
16	L21. Information Theory (Review)	기말고사 (30%)	

# 5. Textbook – (1) 오일석 "기계학습"

## ◆ 기계학습

- 오일석 저, 한빛아카데미 2017

Chapter 01 소개

Chapter 02 기계 학습과 수학 (2.1 선형대수, 2.2 확률과 통계, 2.3 최적화)

Chapter 03 다층 퍼셉트론

Chapter 04 딥러닝 기초 (X)

Chapter 05 딥러닝 최적화 (5.1 목적함수, 5.3 규제의 필요성과 원리, 5.4 규제 기법, 5.5

하이퍼 매개변수 최적화)

Chapter 06 비지도 학습 (6.1 지도 학습과 비지도 학습, 6.2 비지도 학습, 6.3 군집화, 6.4  
밀도 추정, 6.5 공간 변환의 이해, 6.6 선형 인자 모델, 6.7 오토인코더, 6.8 매니폴드 학습)

Chapter 07 준지도 학습과 전이 학습 (X)

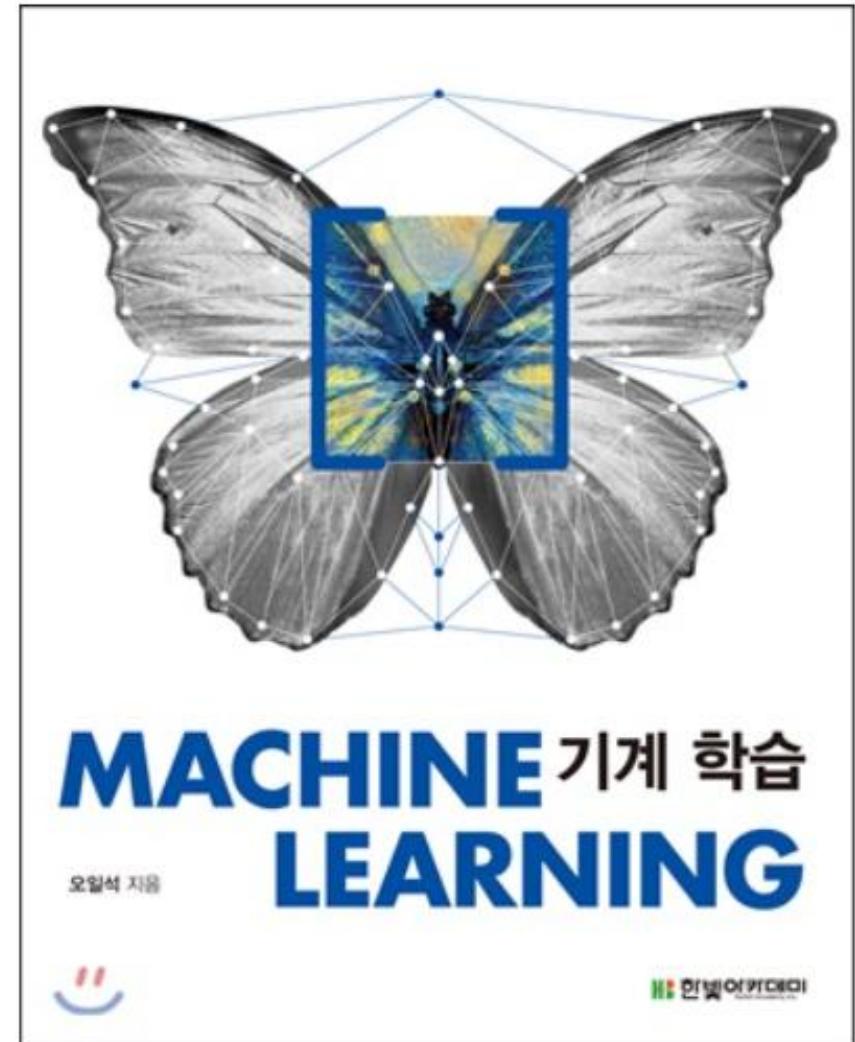
Chapter 08 순환 신경망 (X)

Chapter 09 강화 학습 (X)

Chapter 10 확률 그래피컬 모델 (X)

Chapter 11 커널 기법 (11.1 커널 트릭, 11.4 SVM 분류, 11.5 SVM 회귀)

Chapter 12 양상블 방법 (12.1 동기와 원리, 12.2 재샘플링 기법, 12.3 결정 트리와 랜덤  
포리스트, 12.4 양상블 결합)



# 5. Textbook – (2) Coursera "Machine Learning"

## ◆ Overview

- by Andrew Ng
- Free online course: <https://www.coursera.org/learn/machine-learning>
- Pros: video lectures, easy to follow, deals essential topics
- Cons: No textbook to read, Matlab instead of Python
- ★ More in-depth version is CS229 ML: <http://cs229.stanford.edu/>

## ◆ TOC

- Introduction
- Linear Regression with One Variable
- Linear Regression with Multiple Variables
- Logistic Regression
- Neural Networks: Representation
- Neural Networks: Learning
- Advice for Applying Machine Learning
- Support Vector Machines
- Unsupervised Learning
- Dimensionality Reduction
- Anomaly Detection
- Recommender Systems
- Large Scale Machine Learning
- Application Example: Photo OCR

The screenshot shows the Coursera course page for 'Machine Learning' by Andrew Ng. The page has a red header with the title '기계 학습' and a 4.9 rating from 155,235 reviews. It features a photo of Andrew Ng and information from Stanford University. A large white button at the bottom left says '무료로 등록' (Free Registration). Below it, a box states '재정 지원 가능' (Financial Aid Available) and shows '3,931,270명이 이미 등록했습니다.' (3,931,270 people have already registered).

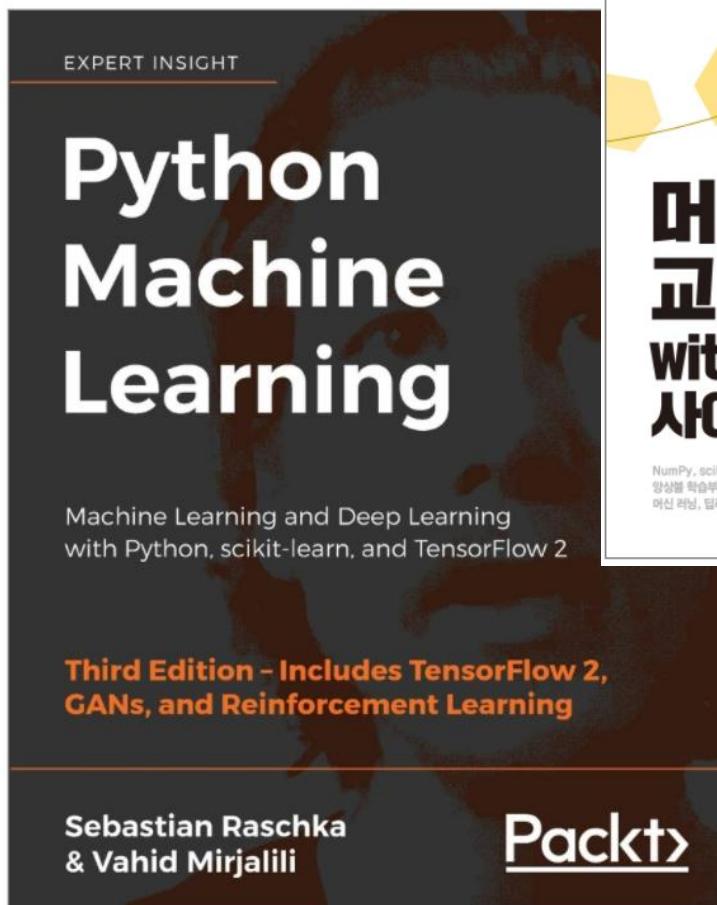
# 5. Textbook – (3) Python Machine Learning 3/E

## ◆ Overview

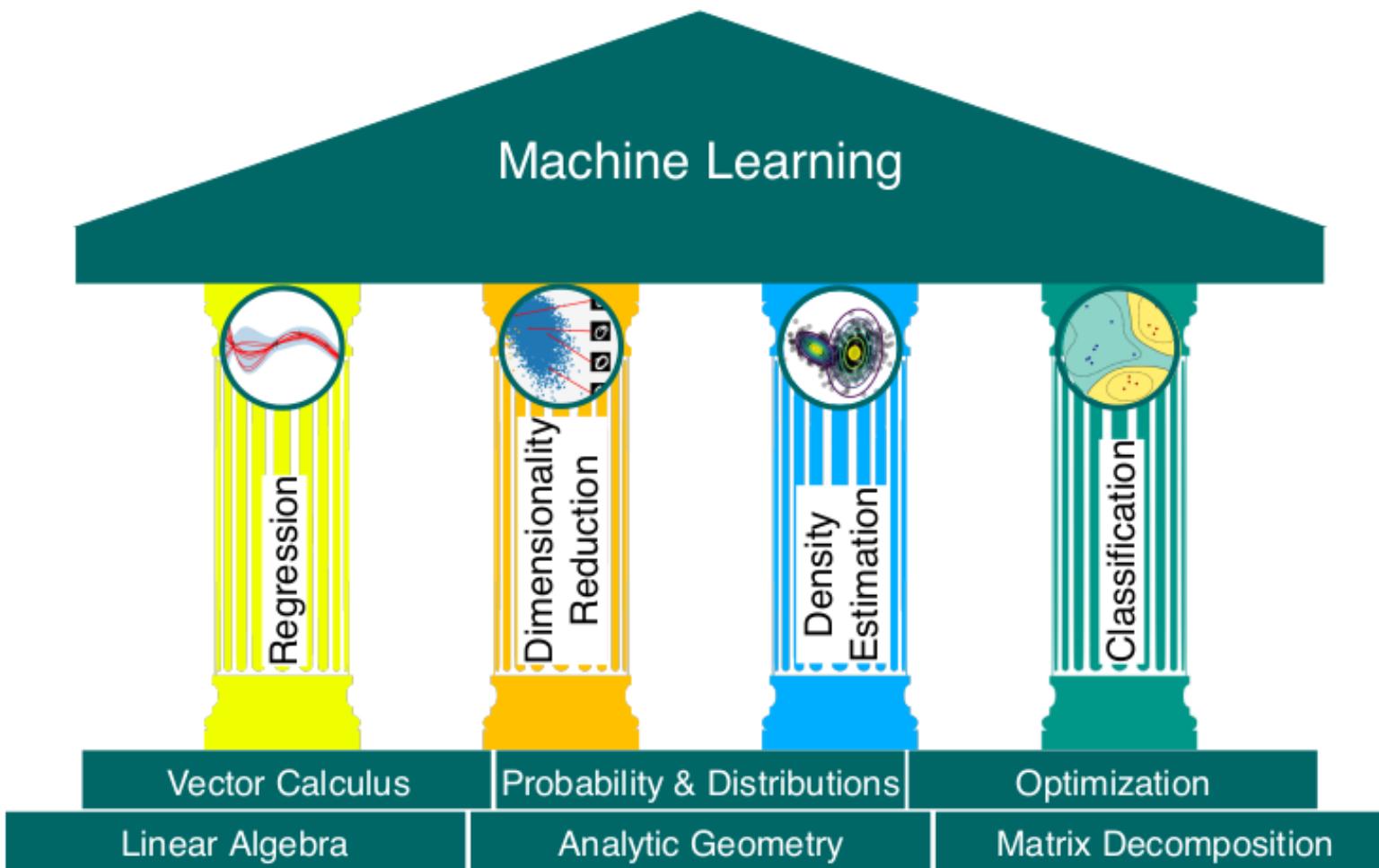
- By Sebastian Raschka (Packt Publishing, 2019)
- 번역서(3판): "머신러닝 교과서 with 파이썬, 사이킷런, 텐서플로" (박해선 역, 길벗 2021)
- Pros: 실습 중심, 실용적
- Cons: 이론 설명이 충분하지 못함

## ◆ TOC

- Giving Computers the Ability to Learn from Data
- Training Simple Machine Learning Algorithms for Classification
- A Tour of Machine Learning Classifiers Using scikit-learn
- Building Good Training Datasets - Data Preprocessing
- Compressing Data via Dimensionality Reduction
- Learning Best Practices for Model Evaluation and Hyperparameter Tuning
- Combining Different Models for Ensemble Learning
- Applying Machine Learning to Sentiment Analysis
- Embedding a Machine Learning Model into a Web Application
- Predicting Continuous Target Variables with Regression Analysis
- Working with Unlabeled Data - Clustering Analysis
- Implementing a Multilayer Artificial Neural Network from Scratch
- Parallelizing Neural Network Training with TensorFlow
- Going Deeper - The Mechanics of TensorFlow
- Classifying Images with Deep Convolutional Neural Networks
- Modeling Sequential Data Using Recurrent Neural Networks
- Generative Adversarial Networks for Synthesizing New Data
- Reinforcement Learning for Decision Making in Complex Environments



# (Cf.) Four Pillars of Machine Learning



# (참고-1) Linear Algebra

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- ◆ Data Representation
- ◆ Model Representation

# (참고-2) Vector Calculus & Optimization Theory

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## ◆ Optimization

- Loss
- Training (Gradient)

# (참고-3) Probability & Statistics

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- ◆ Assumption about the Data
- ◆ Probabilistic (Statistical) Decision & Estimation

# Q & A

본 강의 영상(자료)는 경희대학교 수업목적으로 제작·게시된 것이므로 수업목적 외 용도로 사용할 수 없으며, 무단으로 복제, 배포, 전송 또는 판매하는 행위를 금합니다. 이를 위반 시 민·형사상 법적 책임은 행위자 본인에게 있습니다.

# Appendix – Other Resources

1. 패턴인식 (Book)
2. Pattern Recognition & Machine Learning (Book)
3. Mathematics for Machine Learning (Book)
4. Deep Learning (Book)

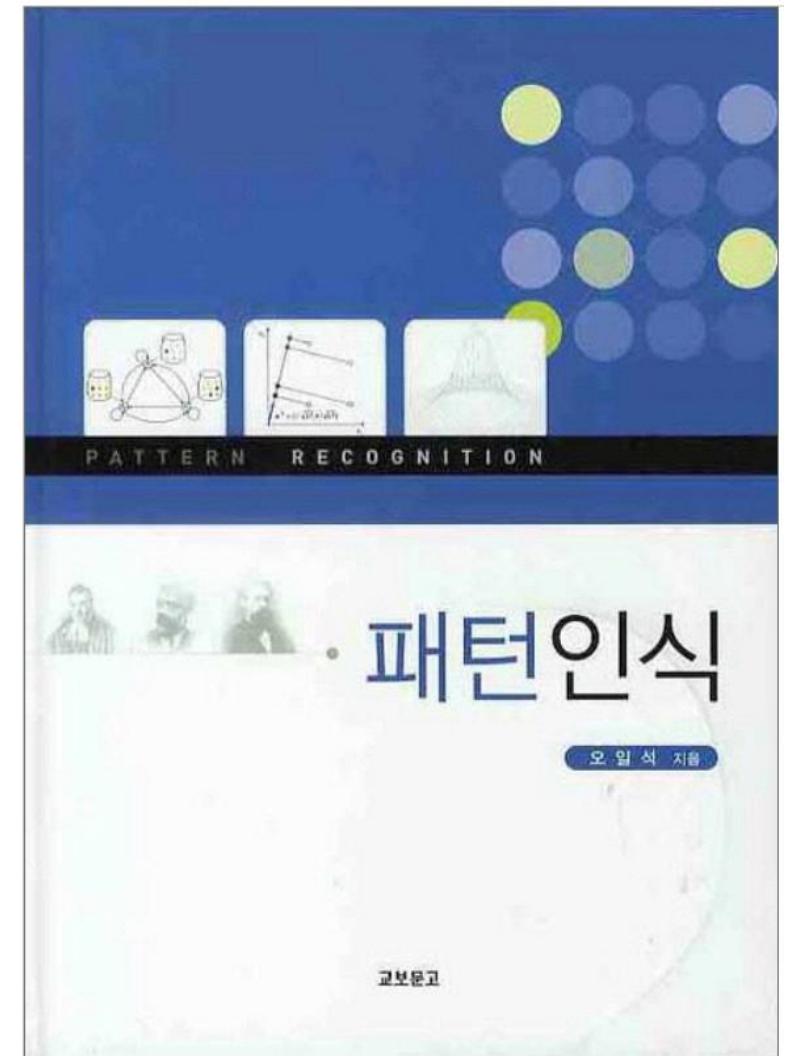
# 패턴인식 (Book)

## ◆ Overview

- By 오일석 (교보문고, 2008)
- Pros: 기계학습의 주요 이론들을 깊이있게 설명
- Cons: 회귀분석 약함, 이론 중심이라 실습부분이 약함

## ◆ TOC

- 소개
- 베이시언 결정 이론
- 확률 분포 추정
- 신경망
- SVM
- 질적 분류
- 순차 데이터의 인식
- 특징 추출
- 특징 선택
- 특징의 분별력
- 군집화
- 최적화 알고리즘
- 혼성 모델



# Pattern Recognition & Machine Learning (Book)

## ◆ Overview

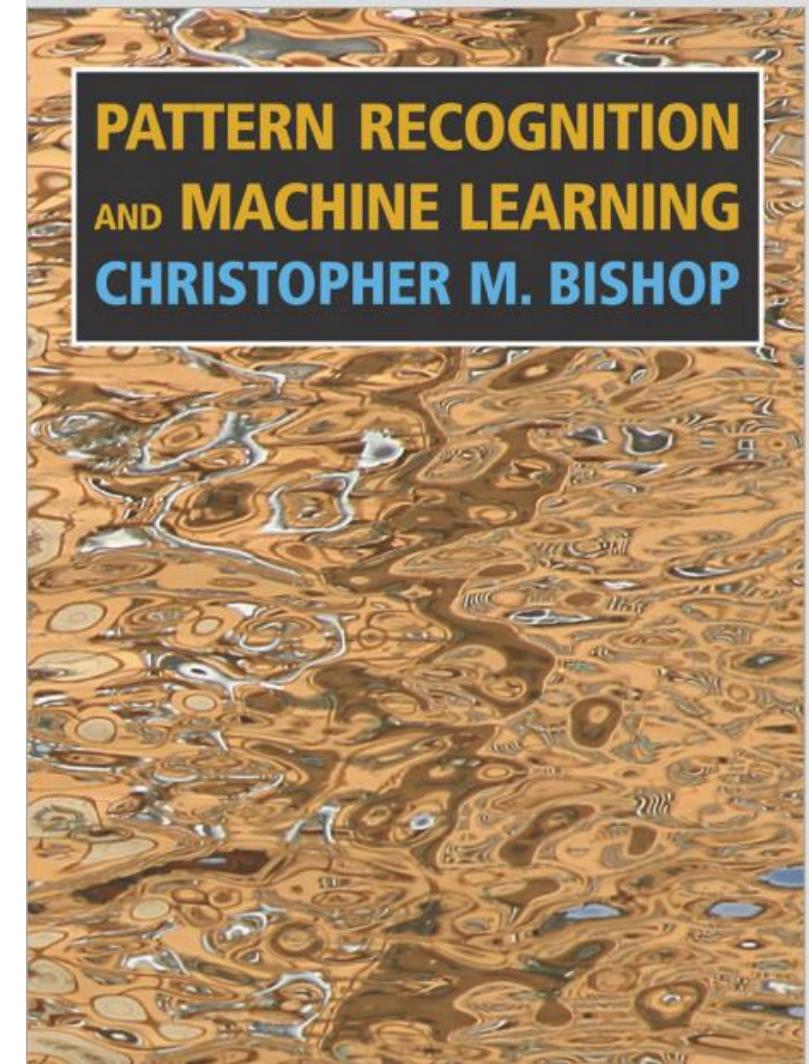
- By Christopher M. Bishop
- Free PDF at <https://www.microsoft.com/en-us/research/people/cmbishop/prml-book/>
- 번역서: "패턴인식과 머신러닝" (김형진 역, 제이펍 2018)
- Pros: a kind of Bible, balanced math & examples
- Cons: 확률/통계적 접근이 강함, 선형대수/확통 사전 지식이 필요함

## ◆ TOC

- Introduction
- Probability distributions
- Linear models for regression
- Linear models for classification
- Neural networks
- Kernel methods
- Sparse Kernel machines
- Graphical models
- Mixture models and EM
- Approximate inference
- Sampling methods
- Continuous latent variables
- Sequential data
- Combining models

## ◆ TOC

1. 소개
2. 확률 분포
3. 선형 회귀 모델
4. 선형 분류 모델
5. 뉴럴 네트워크
6. 커널 방법론
7. 희박한 커널 머신
8. 그래프 모델
9. 혼합 모델과 EM
10. 근사 추정
11. 표집법
12. 연속 잠재 변수
13. 순차 데이터
14. 모델 조합



# Mathematics for Machine Learning (Book)

## ◆ Overview

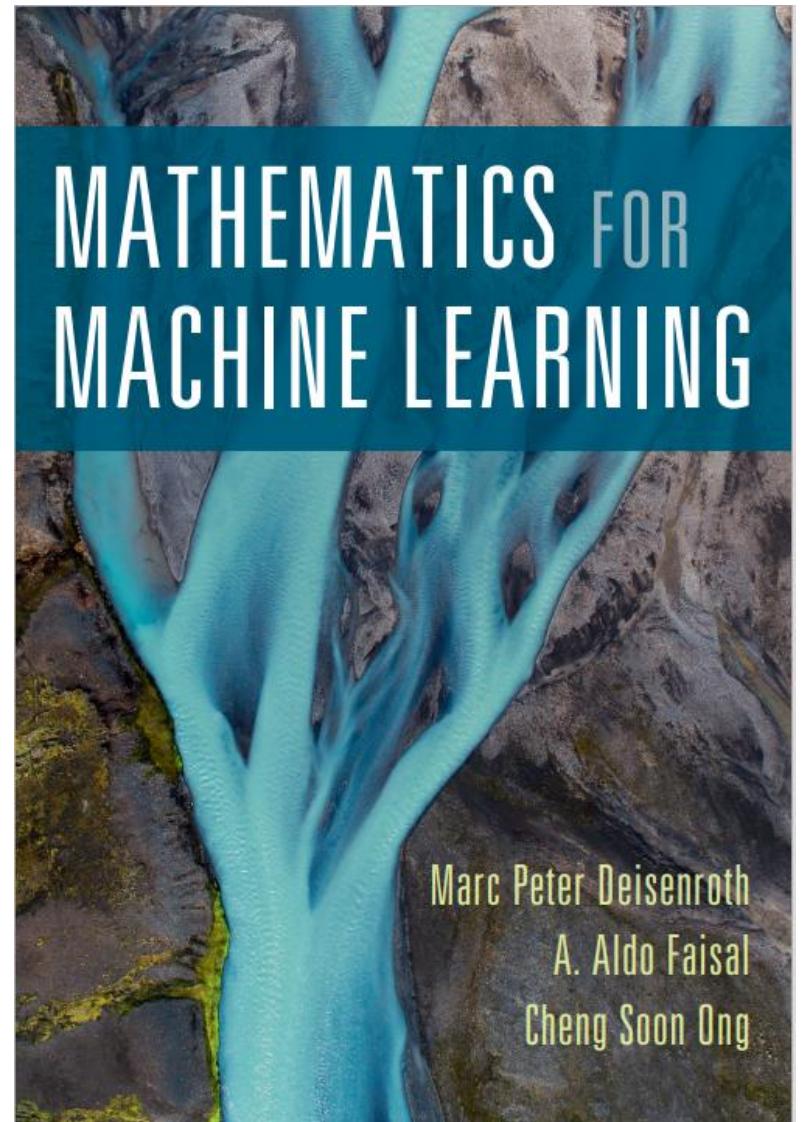
- By Deisenroth, Faisal, and Ong
- Free PDF at <https://mml-book.com>
- Pros: 수학적 기초를 탄탄히 할 수 있음 (단, 정보이론은 누락됨)
  - ★ 한글 슬라이드(고려대): [http://savanna.korea.ac.kr/wp/?page\\_id=605](http://savanna.korea.ac.kr/wp/?page_id=605)
- Cons: 너무 수학적이라 공부하는 데 시간이 많이 걸림

## ◆ Part I: Mathematical Foundations

- Introduction and Motivation
- Linear Algebra
- Analytic Geometry
- Matrix Decompositions
- Vector Calculus
- Probability and Distribution
- Continuous Optimization

## ◆ Part II: Central Machine Learning Problems

- When Models Meet Data
- Linear Regression
- Dimensionality Reduction with Principal Component Analysis
- Density Estimation with Gaussian Mixture Models
- Classification with Support Vector Machines



# Deep Learning (Book)

## ◆ Overview

- By Ian Goodfellow, Yoshua Bengio, Aaron Courville
- HTML available at <https://www.deeplearningbook.org/>
- Pros: 명사의 책, 강의 슬라이드와 비디오 제공(훌륭하진 못함..)
  - ★ slide: [https://www.deeplearningbook.org/lecture\\_slides.html](https://www.deeplearningbook.org/lecture_slides.html)
  - ★ video: <https://www.youtube.com/c/AlenaKruchkova/playlists>
- Cons: 책 자체는 설명이 짧아 수학적 기초 있어야 이해 가능

## ◆ Part I: Applied Math and Machine Learning Basics

- Linear Algebra
- Probability and Information Theory
- Numerical Computation
- Machine Learning Basics

## ◆ Part II: Modern Practical Deep Networks

- Deep Feedforward Networks
- Regularization for Deep Learning
- Optimization for Training Deep Models
- Convolutional Networks
- Sequence Modeling: Recurrent and Recursive Nets
- Practical Methodology
- Applications

## ◆ Part III: Deep Learning Research

13. Linear Factor Models
14. Autoencoders
15. Representation Learning
16. Structured Probabilistic Models for Deep Learning
17. Monte Carlo Methods
18. Confronting the Partition Function
19. Approximate Inference
20. Deep Generative Models

