

IF5181 Pengenalan Pola

Pendahuluan

Masayu Leylia Khodra



Outline

- Pengantar kuliah IF5181
- Pengenalan Pola:
 - Definisi pola, kategori pola, pengenalan pola
 - Aplikasi pengenalan pola
 - Pendekatan pengenalan pola

Pengantar Kuliah IF5181 (3 sks)

- Pengajar: Masayu Leylia K (masayu@informatika.org)
- Tatap muka: Rabu 16.00-16.50; Jumat 15.00-16.40
- Mailing-list: if5181@students.if.itb.ac.id
- Situs Kuliah: google classroom IF5181

Luaran Kuliah

1. Mahasiswa mampu **mendeskrripsikan dan membangun modul** untuk membangun suatu sistem pengenalan pola.
2. Mahasiswa mampu **mendefinisikan** metode/ teknik pengenalan pola yang sesuai untuk kasus tertentu.
3. Mahasiswa mampu **membangun secara utuh** suatu sistem pengenalan pola untuk suatu kasus.
4. Mahasiswa mampu **mengevaluasi kinerja** suatu sistem pengenalan pola.

Materi Kuliah

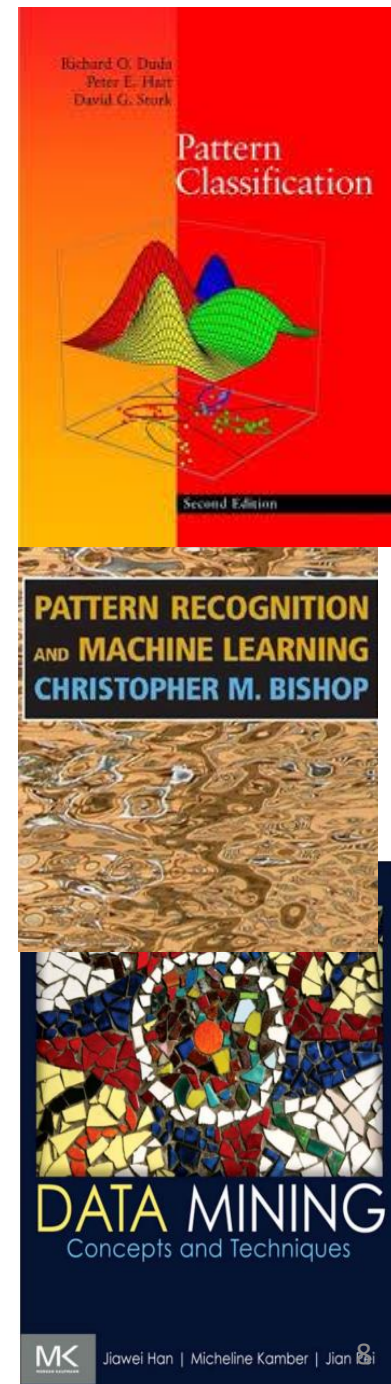
1. Pendahuluan:
 1. DS-AI: What is AI
 2. DS-AI: Intelligent Agent
2. Pattern Recognition System
3. Classification
 1. DS-AI: Knowledge-based system
 2. DS-AI: Bayesian Network
 3. DS-AI: Hidden Markov Model
4. Clustering
5. Pengenalan Pola untuk Data Sekuens
6. Pengenalan Pola pada Teks

Penilaian

- Komponen: UTS, UAS, Kuis, PR & latihan, Tugas
- Syarat lulus IF5181: nilai setiap komponen > 0
- Segala bentuk kecurangan akan mengakibatkan nilai E
- Susulan UTS UAS hanya untuk mahasiswa yang dirawat di rumah sakit atau terkena musibah. Susulan hanya untuk UTS atau UAS (tidak keduanya)

Referensi

- R. Duda, P. Hart, and D. Stork, Pattern Classification, 2nd ed. John Wiley & Sons, 2001
- C. Bishop, Pattern Recognition and Machine Learning. Springer, 2006
- Stuart J Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice-Hall International, Inc, 2010, Textbook
- Han, J., Pei, J., & Kamber, M. (2011). Data mining: concepts and techniques. Elsevier.
- Digital library / <http://scholar.google.com/>



Modul 1: Introduction

01 What & Why Pattern Recognition

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Pengenalan Pola
(*Pattern Recognition*)



Pattern Recognition Introduction

**What &
Why**

**Pattern
Recognition,
Artificial
Intelligence, and
Machine Learning**

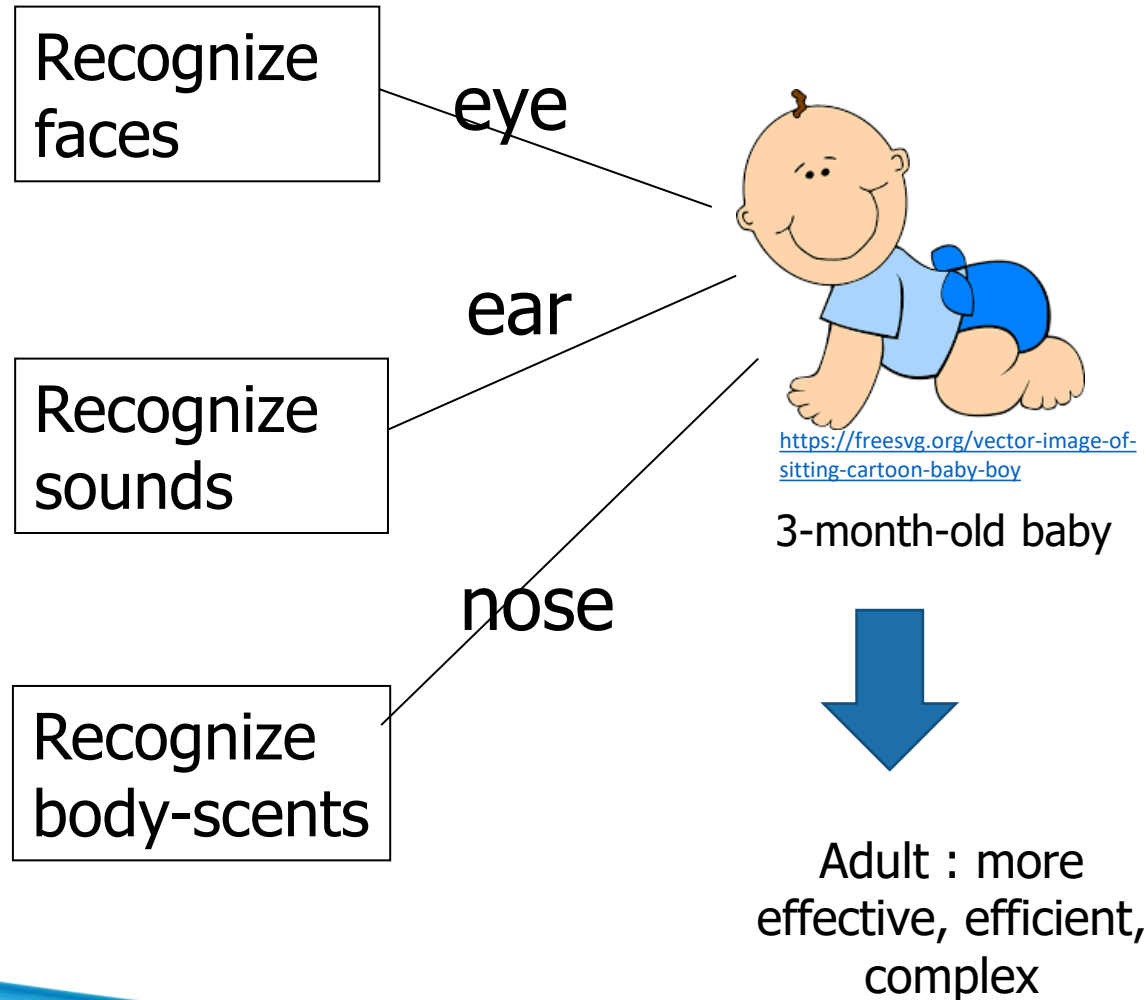
**Supervised vs
Unsupervised
Classification**

**Pattern
Recognition as
Intelligent
Agent**

**Pattern
Recognition
Approaches**



Human as The Best Pattern Recognizer



Humans are the best pattern recognizers in most scenarios, yet we do not fully understand how we recognize patterns. (Jain & Duin, 2004)

Pattern recognition is critical in most human decision-making tasks. (Jain, 1999)



Pattern Recognition

Pattern

- common denominator among the multiple instances of an entity (Jain, 2004)



Recognition

- Identification of a pattern as a member of a category (class) we already know, or we are familiar with (Jain, 2017)



Pattern recognition

- automatic discovery of **regularities** in data through the use of computer algorithms and with the use of these regularities to take actions such as classifying the data into different categories (Bishop, 2006)



Why Pattern Recognition ?

Speech recognition

Face recognition

text recognition

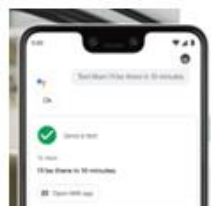
Handwriting recognition

... recognition

- PR is a need that appears in many practical problems. We as humans do pattern recognition very well, but getting a computer to do the same is complicated.
- “The better computers get at pattern recognition, the more human-like they will become”. Ray Kurzweil, NY Times, Nov 24, 2003



PR Application: Speech Recognition



“Hey Google, text
Mum I'll be there in 10
minutes”

Debat Capres #5

Ekonomi dan Kesejahteraan Sosial, Keuangan dan Investasi,
serta Perdagangan dan Industri

13 April 2019 | Status Pengolahan Data : Selesai

Transkrip Lengkap

Search

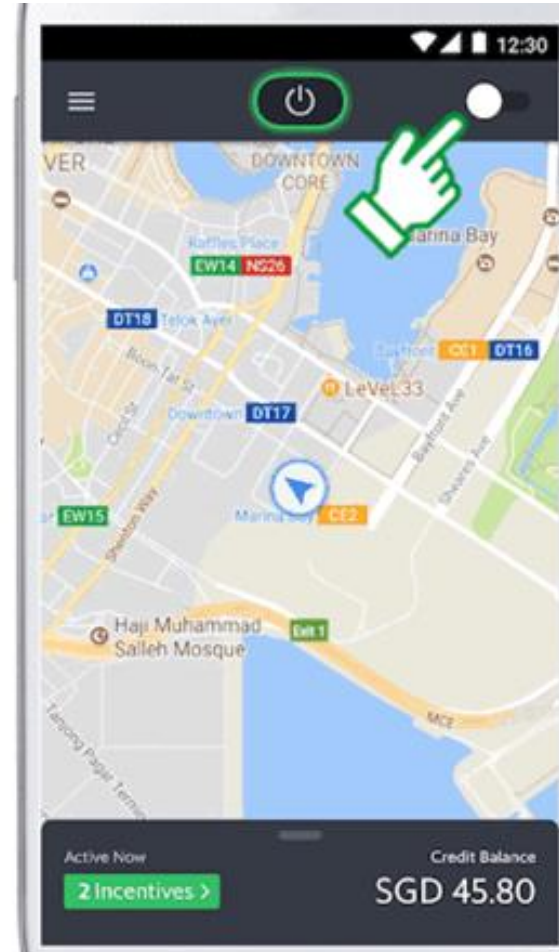
No	Pembicara	Waktu (WIB)	Transkrip
1	Balques Manisang	20:04	baik kami meminta hadirin baik kami meminta hadirin berdiri karena kita akan bersama sama menyanyikan lagu kebangsaan Indonesia raya
2	pembicara	20:04	(Lagu Kebangsaan Indonesia Raya)
3	Balques Manisang	20:06	pak Maruf Amin untuk bersalaman juga dengan Prabowo Subianto dan bapak Salahudin iya silakan baik tidak sabar rasanya Pak silakan Pak monggo ditempati tempatnya satu-satu
4	Balques	20:07	baik sebelum memulai acara karena sudah siap semua tapi ada yang juga sangat penting untuk memulai acara yang besar ini kita akan membacakan doa menundukan sejenak kepala kita dan yang akan memimpin doa adalah Profesor Kiai Haji Nasaruddin I Umar MA Ph D Imam Besar Masiid Istiglal



PR Application: Face Recognition



https://www.nec.com/en/global/solutions/safety/face_recognition/NeoFaceWatch.html



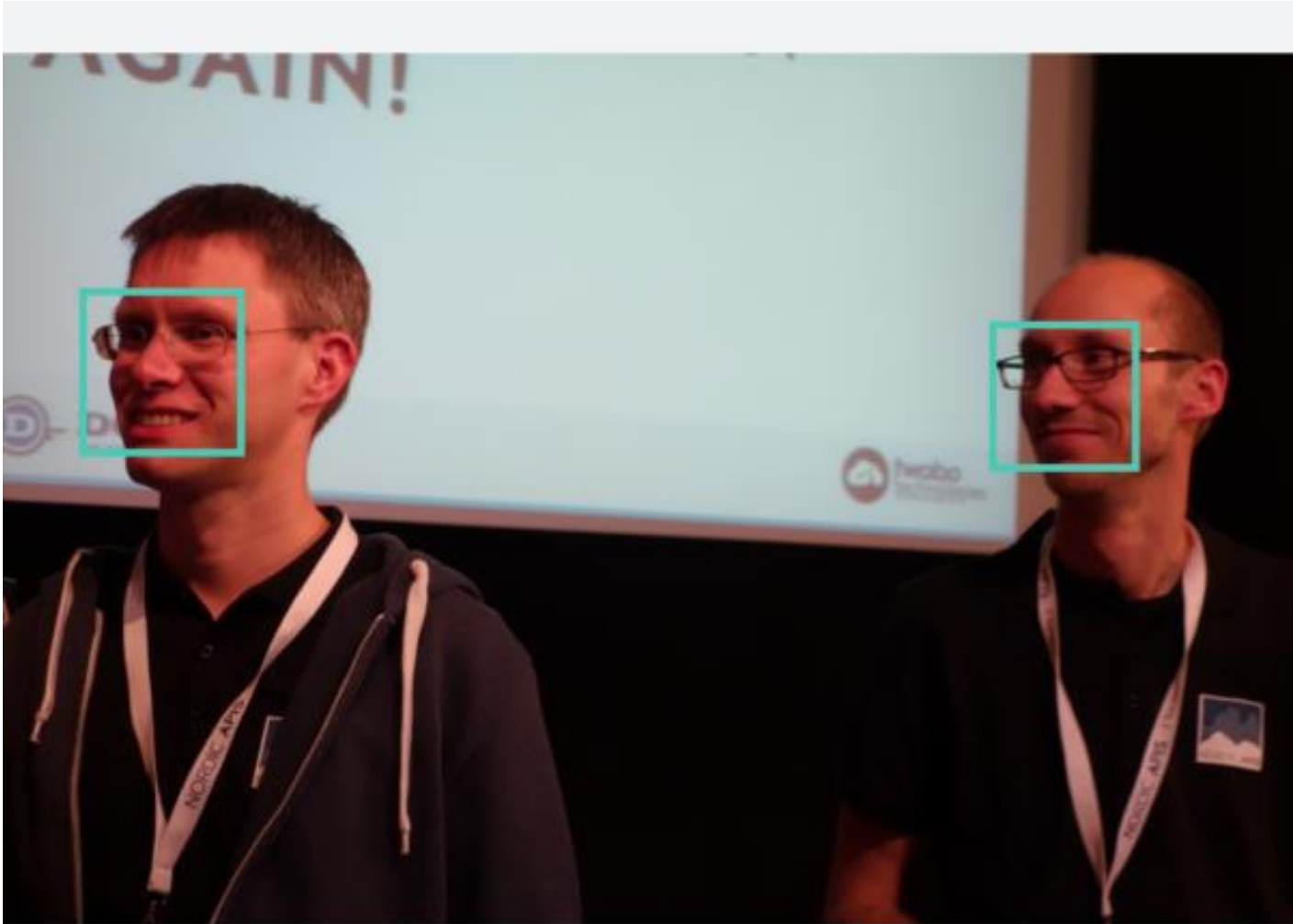
<https://www.grab.com/sg/driver-2/selfieverification/>



<http://www.vvip.co/news/facebook-accused-of-using-10-year-challenge-meme-to-improve-facial-recognition/>



PR Application: Emotion Recognition



Detection Result:
2 faces detected

JSON:

```
[  
  {  
    "faceRectangle": {  
      "left": 120,  
      "top": 362,  
      "width": 255,  
      "height": 255  
    },  
    "scores": {  
      "anger": 6.506412e-7,  
      "contempt": 0.00000107357334,  
      "disgust": 0.0000137053685,  
      "fear": 2.51182275e-9,  
      "happiness": 0.9994379,  
      "neutral": 0.000546224066,  
      "sadness": 1.46409562e-7,  
      "surprise": 2.88747827e-7  
    }  
  }  
]
```



PR Application: Handwriting Recognition



my alarm clock did not
 my alarm code circle shute clock soil raid risk visit did not must

Wake me up this morning
 wake me up thai taxis moving having running morning loving



My alarm clock did not wake me up this morning



PR Application: Text Recognition



Google's Word Lens

<https://mashable.com/2017/01/26/word-lens-japanese/>



PR Application: Text Analysis

In fact, the **Chinese** NORP market has the **three** CARDINAL most influential names of the retail and tech space – **Alibaba** GPE, **Baidu** ORG, and **Tencent** PERSON (collectively touted as **BAT** ORG), and is betting big in the global **AI** GPE in retail industry space. The **three** CARDINAL giants which are claimed to have a cut-throat competition with the **U.S.** GPE (in terms of resources and capital) are positioning themselves to become the 'future **AI** PERSON platforms'. The trio is also expanding in other **Asian** NORP countries and investing heavily in the **U.S.** GPE based **AI** GPE startups to leverage the power of **AI** GPE. Backed by such powerful initiatives and presence of these conglomerates, the market in APAC AI is forecast to be the fastest-growing **one** CARDINAL, with an anticipated **CAGR** PERSON of **45%** PERCENT over

To further elaborate on the geographical trends, **North America** LOC has procured in **2017** DATE and has been leading the regional landscape of **AI** GPE in the retail credit in the regional trends with **over 65%** PERCENT of investments (including M&A: artificial intelligence technology. Additionally, the region is a huge hub for startups in such as **Google** ORG, **IBM** ORG, and **Microsoft** ORG.

<https://www.depends-on-the-definition.com/text-analysis-with-named-entities/>

Polaritas

Aspek

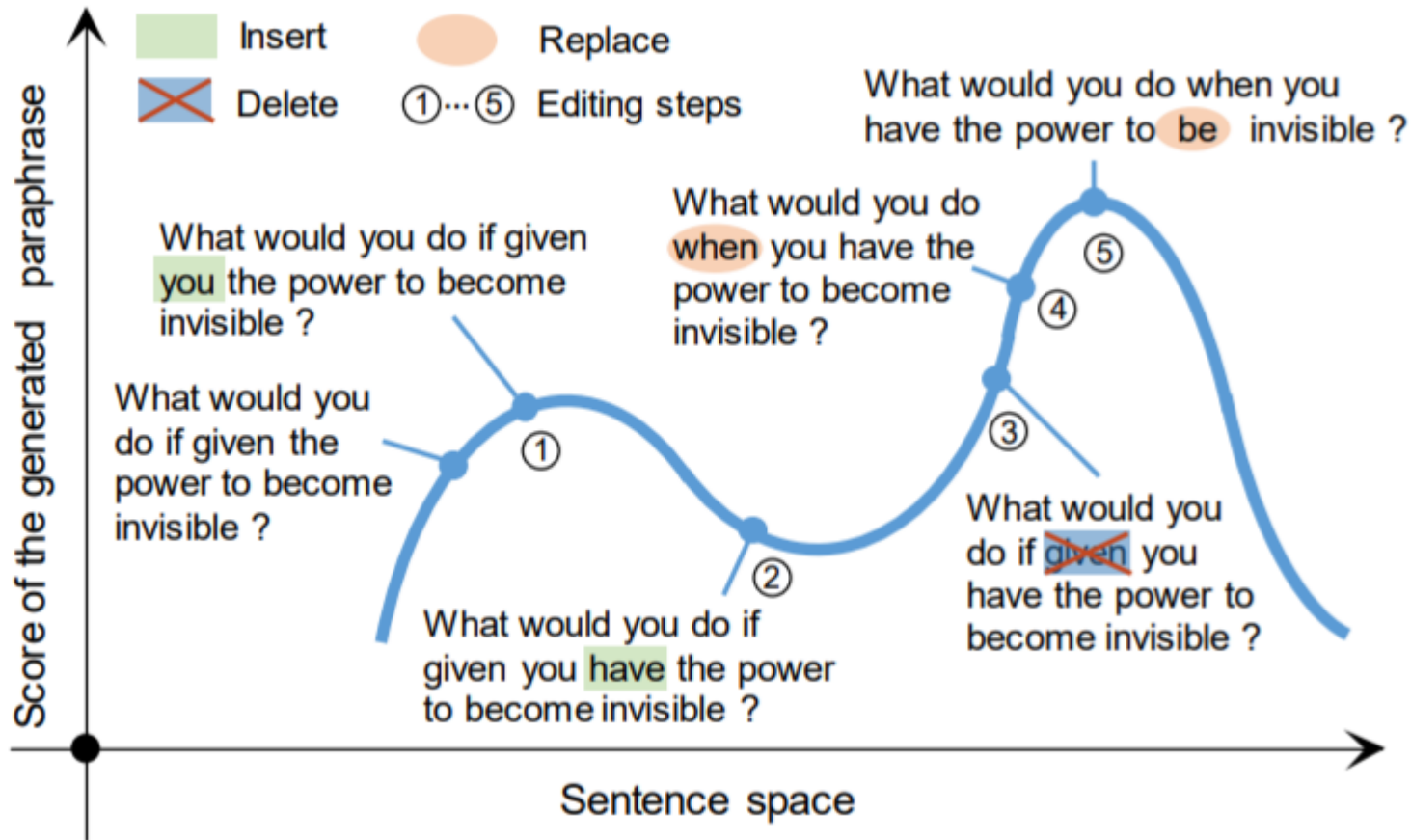
Ekspresi

Keterangan warna: **Positif** **Negatif** **Netral**

Tempatnya bagus banget terlebih ada view kota bandungnya .
Cuma sayang banget kemaren pesen makanan di restoran cave nya lama banget datengnya ampe setengah jam baru dateng , rasanya lumayan , penyajiannya lumayan , harga rata rata di atas 30 . Porsi makanannya besar , cukup untuk dua orang . Lokasi strategis dekat Lembang .



PR Application: Paraphrase Generation



Recognize position

Recognize operator

Recognize replacement

Liu, X., Mou, L., Meng, F., Zhou, H., Zhou, J., & Song, S. (2019). Unsupervised paraphrasing by simulated annealing. *arXiv preprint arXiv:1909.03588*.

<http://nlp.yuliadi.pro/>



PR Application in Self-Driving Car

HOW WAYMO'S SELF-DRIVING CAR WORKS

One of Waymo's three lidar systems that shoots lasers so the car can see its surroundings. Waymo says this lidar can detect a helmet two-football fields away.

A forward facing camera works with 8 others stationed around the car to provide 360 degrees of vision.

Radar sensors can detect objects in rain, fog, or snow.

Waymo's self-driving sensors are tightly integrated into the hybrid minivan created by Fiat Chrysler.



SOURCE: Waymo

BUSINESS INSIDER

Recognize object

Recognize movement

Recognize area

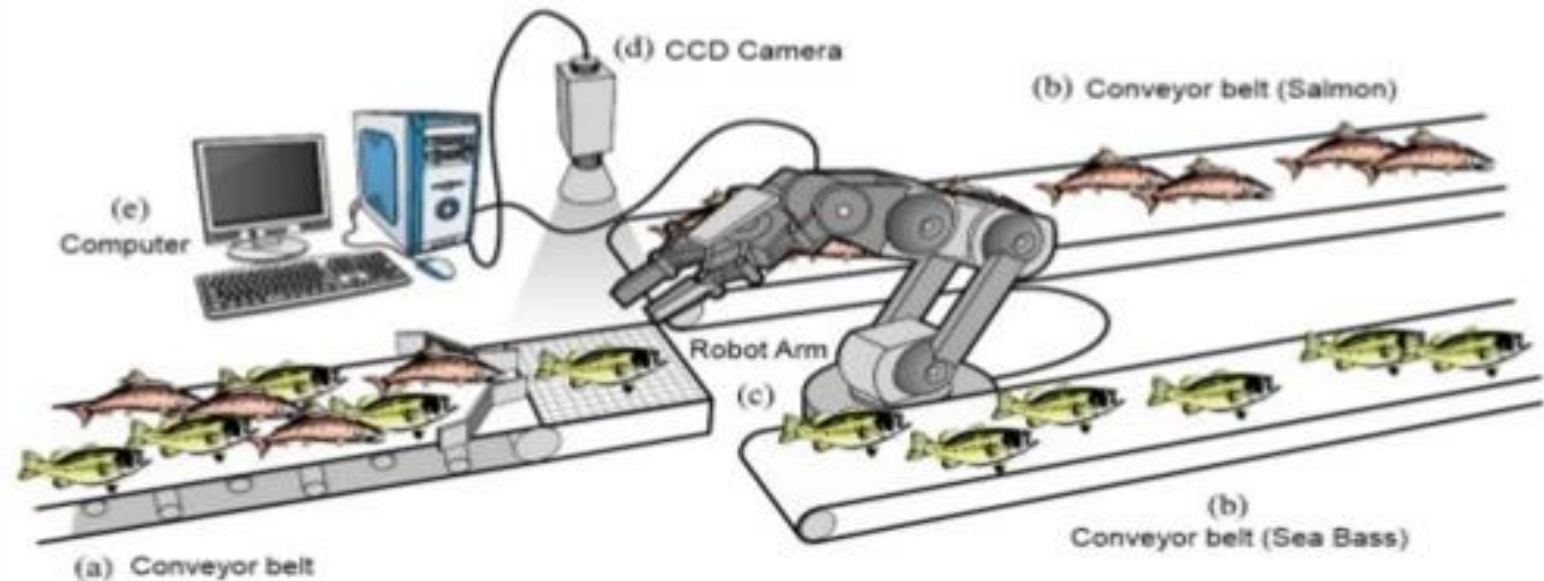
Recognize important info



PR Application in Fish Packing Plant (Duda et al., 2001)

Fish packing plant wants to automate the process of sorting incoming fish on a conveyor belt according to species.

- A: Conveyor belt for fish
- B: Conveyor belt for classified fish
- C: Robot arm for grabbing fish
- D: Machine vision system with CCD camera
- E: Computer that analyze fish image and control the robot arm



Automated Fish Classification System

Summary

What is
Pattern
Recognition

Human as The
Best Pattern
Recognizer

Why Pattern
Recognition

Pattern
Recognition
Applications

Next: Pattern Recognition,
Artificial Intelligence, and
Machine Learning





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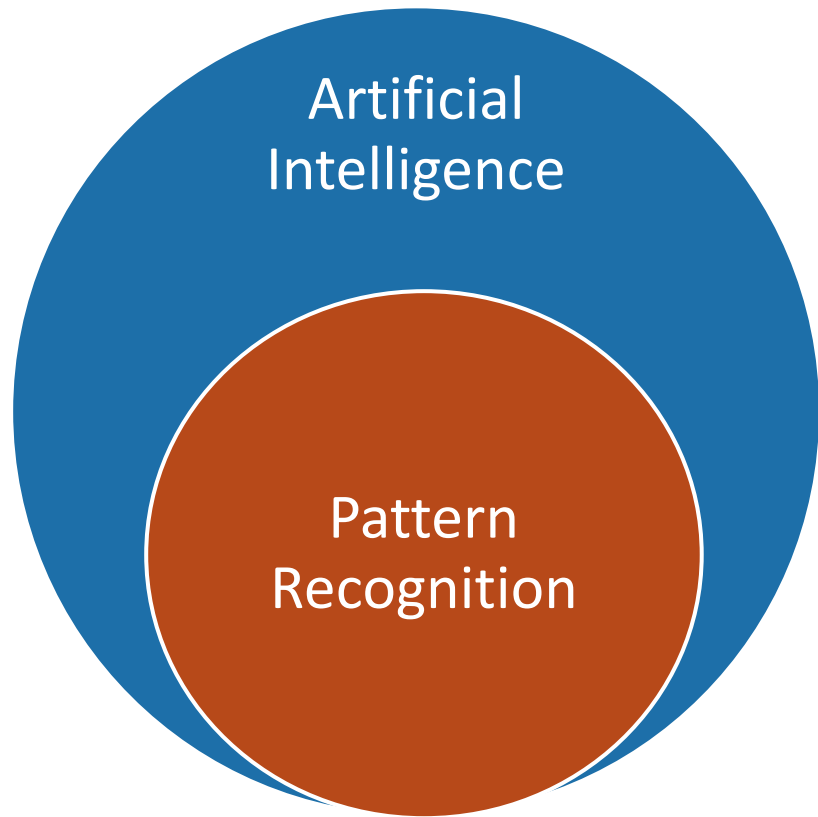
Modul 1: Introduction

02 Pattern Recognition, Artificial Intelligence, and Machine Learning

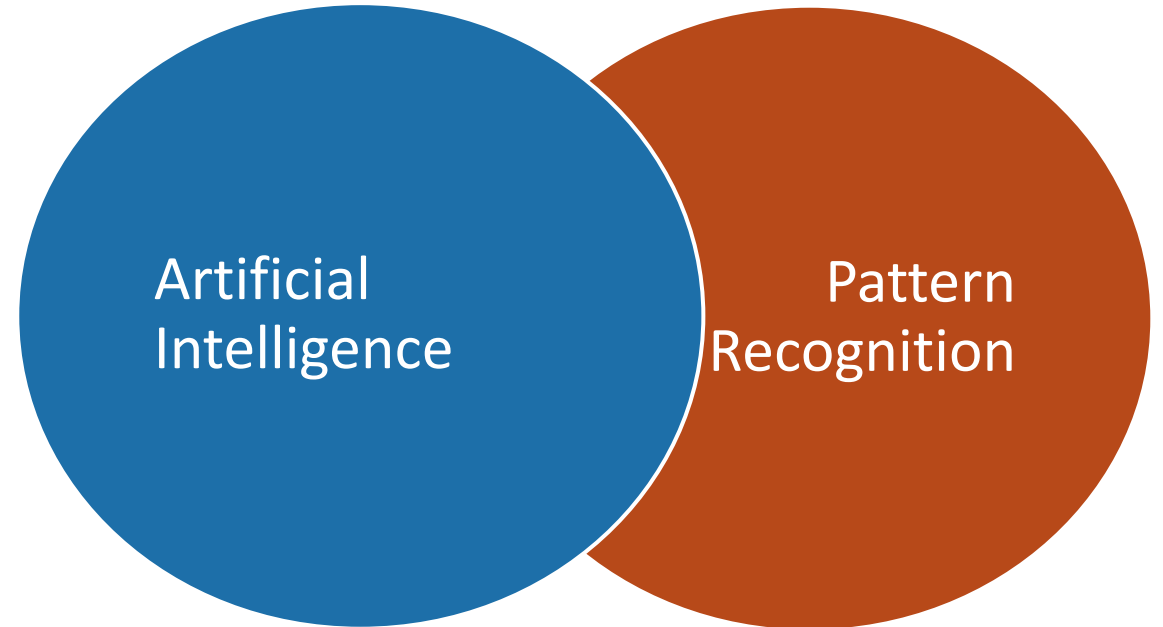
Pengenalan Pola
(*Pattern Recognition*)



Artificial Intelligence vs Pattern Recognition ?



OR



What is AI? 8 Definitions, 4 Approaches

Thinking
humanly

Thinking Humanly

“The exciting new effort to make computers think ... *machines with minds*, in the full and literal sense.” (Haugeland, 1985)

“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning ...” (Bellman, 1978)

Acting
humanly

Acting Humanly

“The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)

“The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)

Thinking Rationally

“The study of mental faculties through the use of computational models.” (Charniak and McDermott, 1985)

“The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)

Thinking
rationally

Acting Rationally

“Computational Intelligence is the study of the design of intelligent agents.” (Poole *et al.*, 1998)

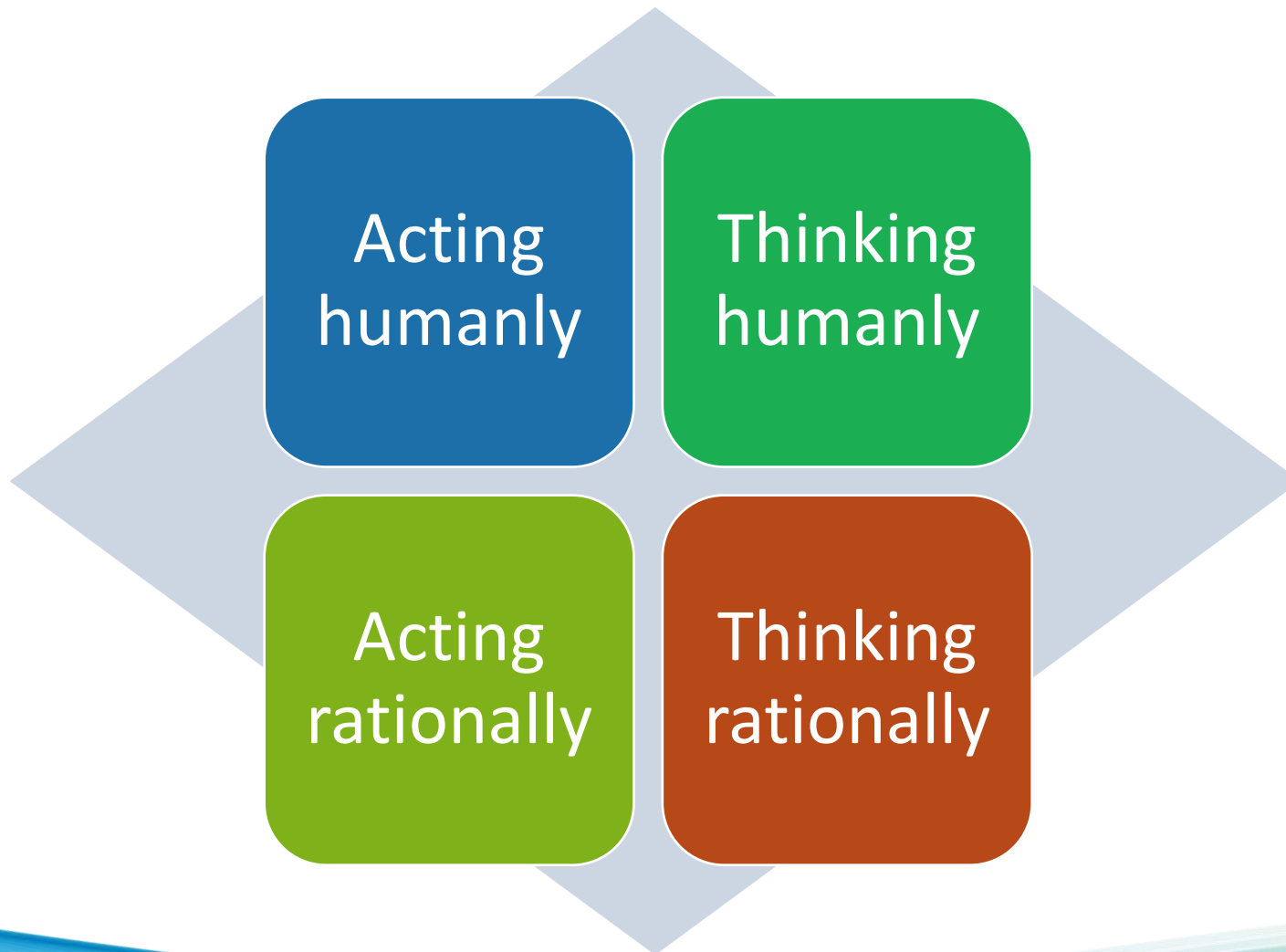
“AI ... is concerned with intelligent behavior in artifacts.” (Nilsson, 1998)

Acting
rationally

Figure 1.1 Some definitions of artificial intelligence, organized into four categories.



Pattern Recognition using AI Approaches

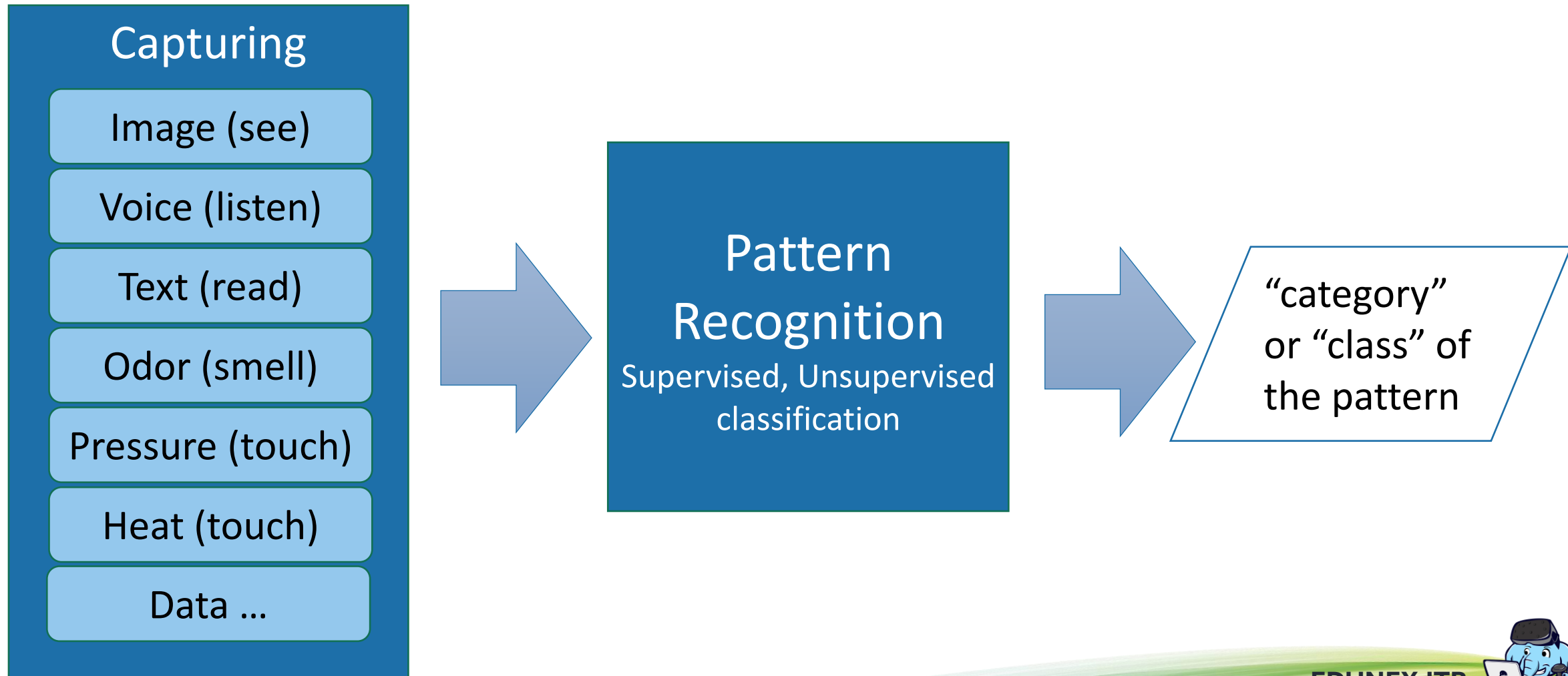


“The real power of human thinking is based on recognizing patterns. The better computers get at pattern recognition, the more humanlike they will become.” Ray Kurzweil, NY Times, Nov 24, 2003

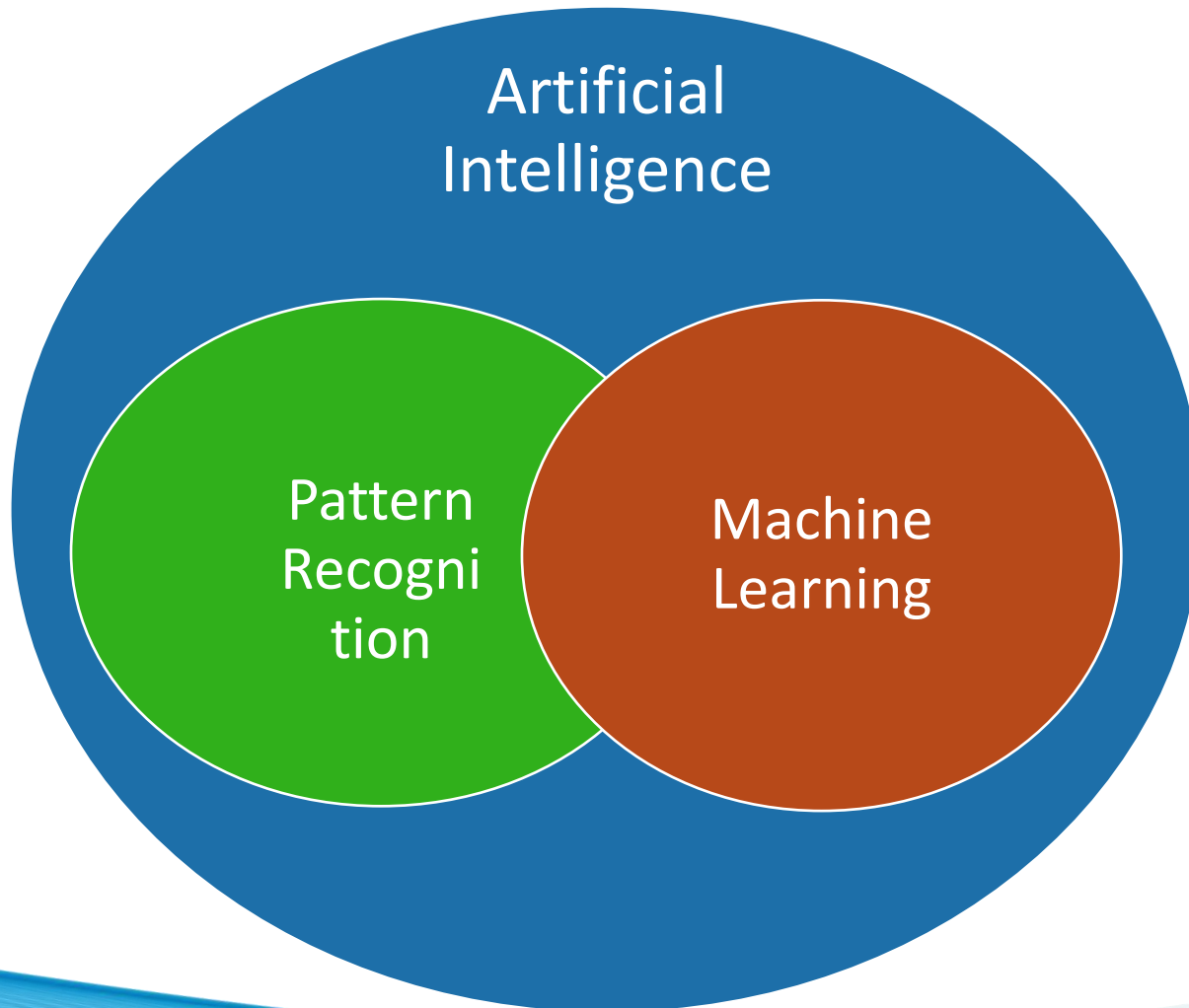
Pattern recognition recognize abstract patterns, a capability that dominates human thinking.



Human-like Pattern Recognition



AI, Pattern Recognition, Machine Learning



- Pattern Recognition is a type of problem while Machine Learning is a type of solution.
<https://medium.com/@muddaprince456/machine-learning-and-pattern-recognition-bb57ff23e185>
- Machine learning:
 - Bidang ilmu yang memberikan komputer kemampuan untuk belajar tanpa diprogram secara eksplisit. (Arthur Samuel, 1959)
 - Suatu program komputer disebut **belajar** dari **pengalaman E** untuk **task T** dan **ukuran kinerja P**, jika kinerjanya untuk task T yang diukur dengan P **meningkat** dengan adanya pengalaman E (Tom Mitchell, 1998)



Summary

AI vs PR

AI Approaches

AI, PR, ML

Supervised vs Unsupervised Classification



THANK YOU



