Pengantar Computer Vision

Kecerdasan Tiruan (KP045)
Universitas Budi Luhur

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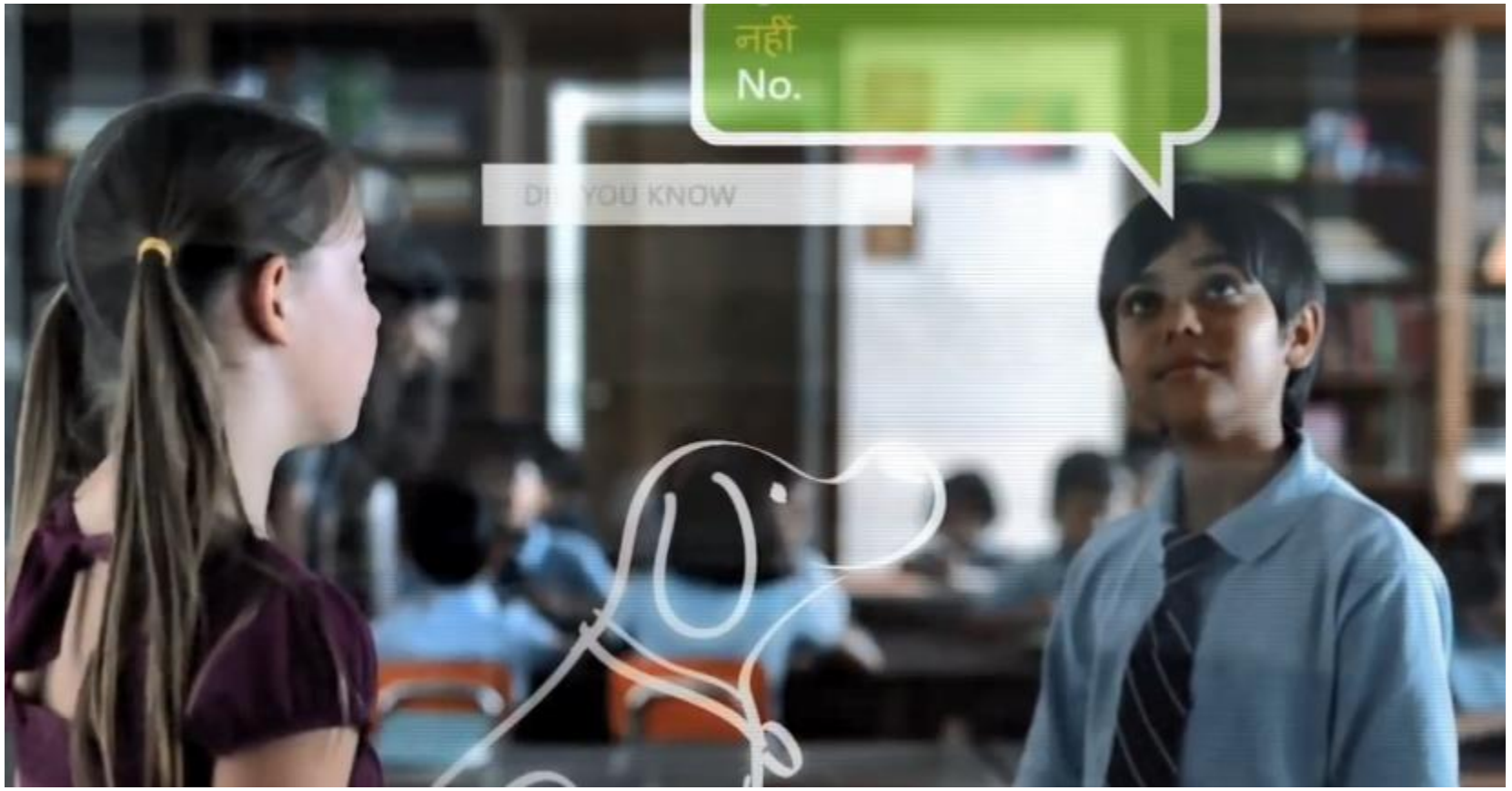
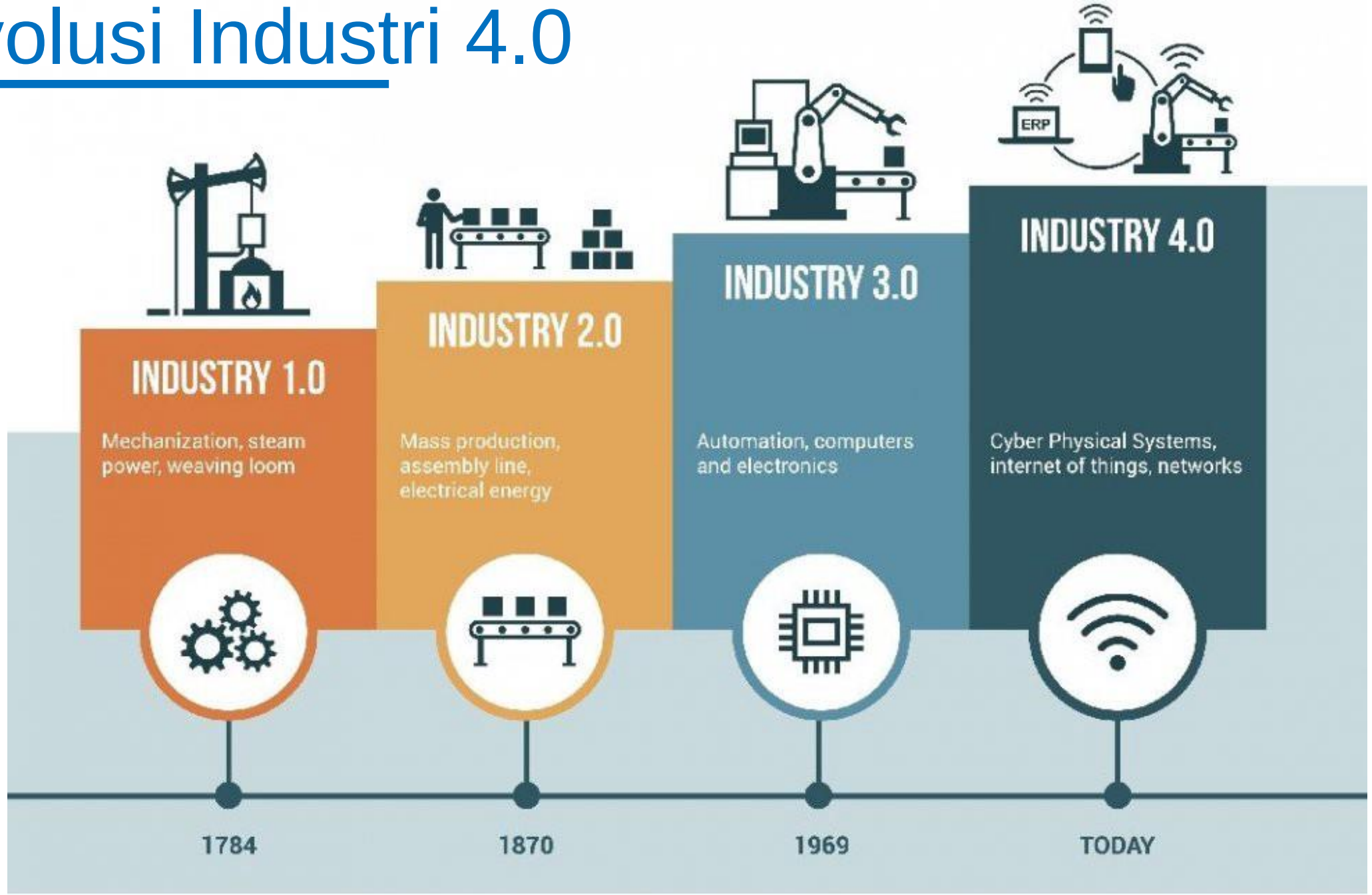
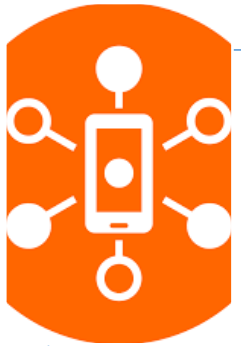


Video: https://www.youtube.com/watch?v=ozLaklIFWUI

Revolusi Industri 4.0



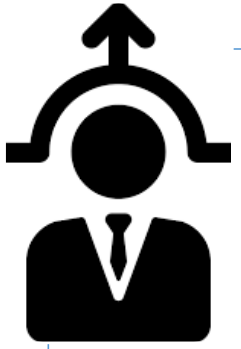
Prinsip Industri 4.0



Interoperability

Information transparency

Technical assistance



Decentralized decision-making

Making Indonesia 4.0

10 STRATEGI PRIORITAS NASIONAL UNTUK MAKING INDONESIA 4.0

Making Indonesia 4.0, sebuah roadmap atau peta jalan mengenai strategi Indonesia dalam implementasi memasuki Industri 4.0 untuk mencapai 10 besar ekonomi terkuat dunia di tahun 2030.

1 Perbaikan Alur Aliran Material

2 Mendesain Ulang Zona Industri

3 Peningkatan Kualitas SDM

4 Pemberdayaan UMKM

5 Menerapkan Insentif Investasi Teknologi

6 Pembentukan Ekosistem Inovasi

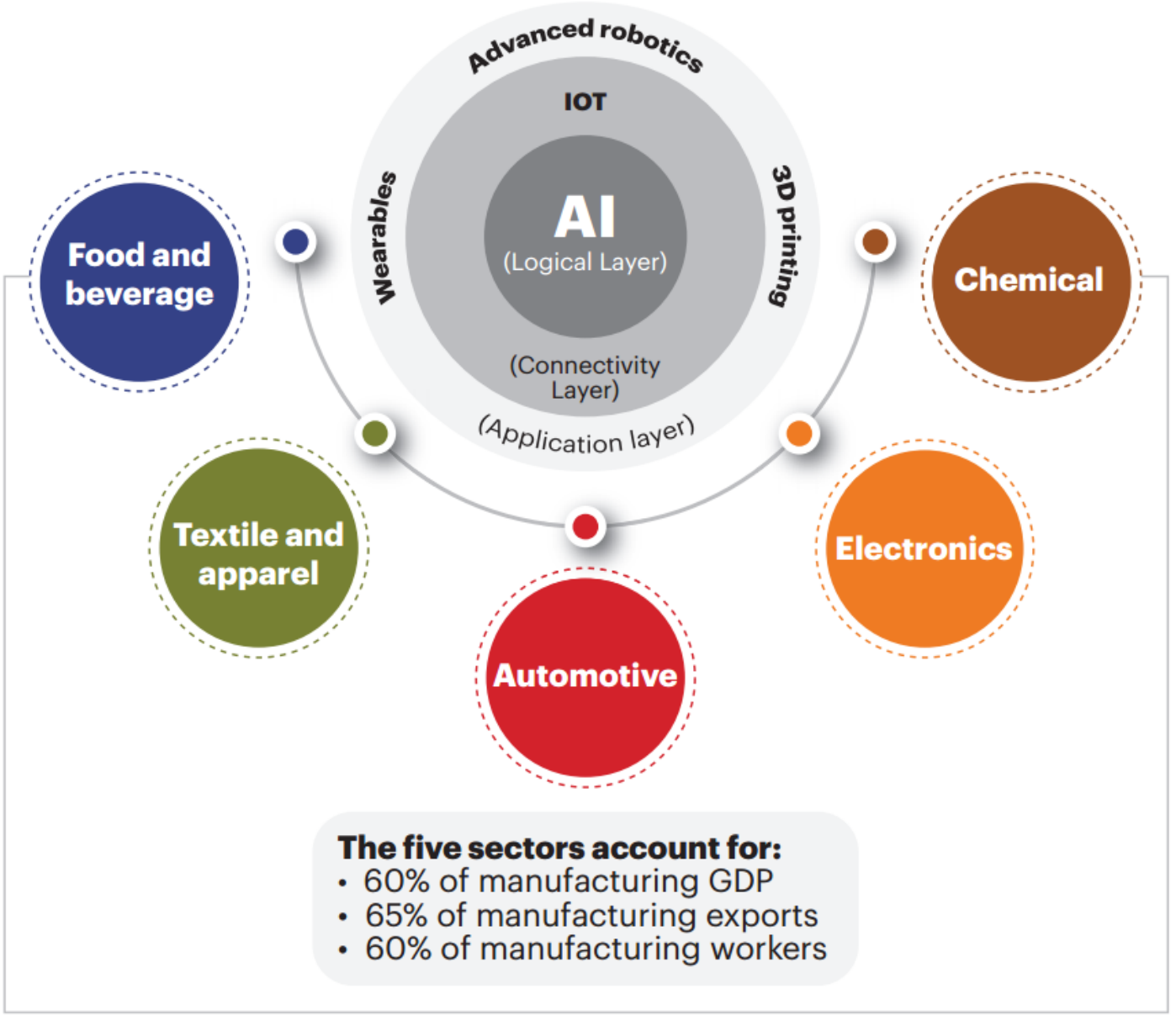
7 Menarik Investasi Asing

8 Harmonisasi Aturan dan Kebijakan

9 Membangun Infrastruktur Digital Nasional

10 Akomodasi Standar Sustainability

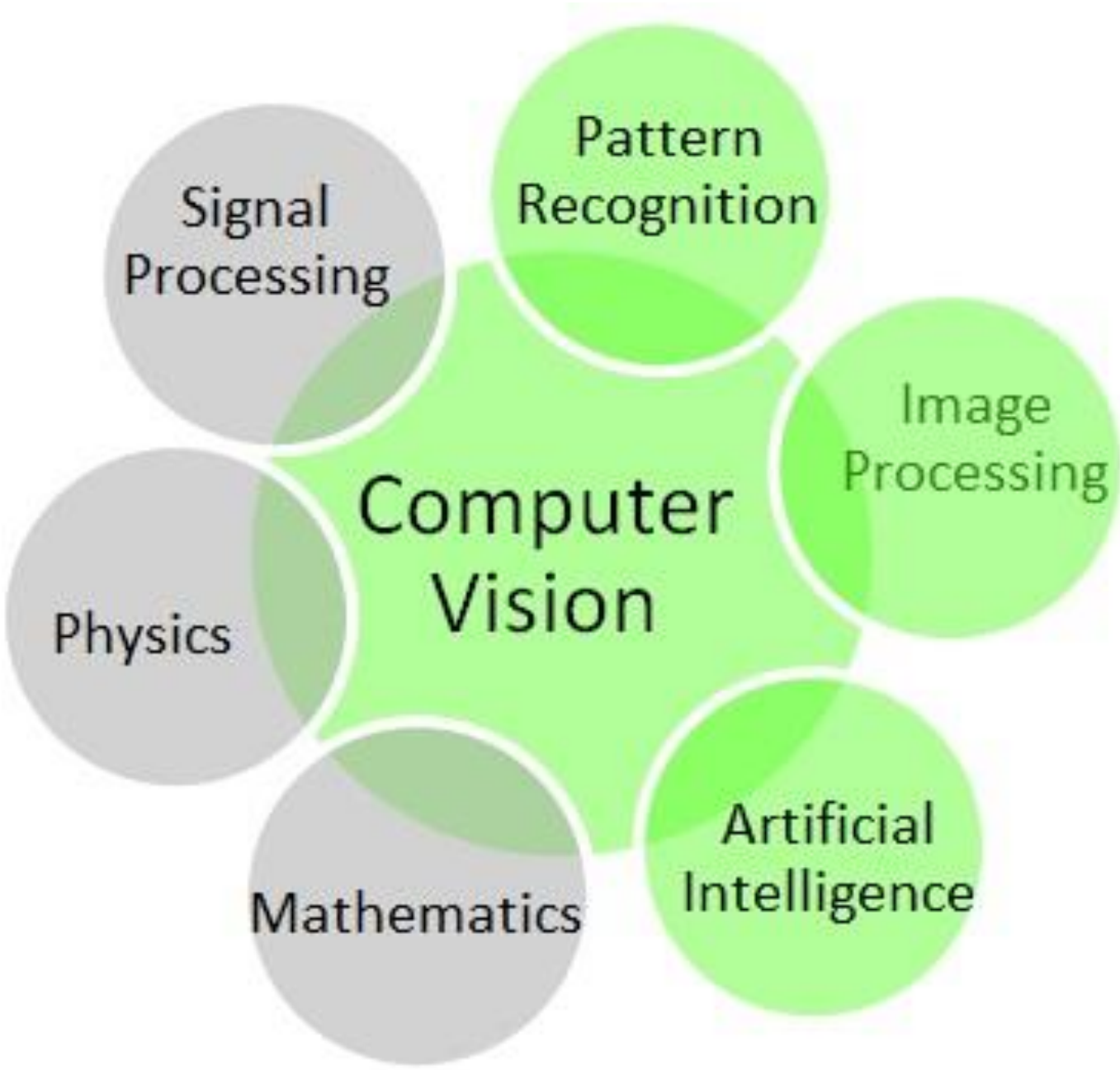
5 Sektor Prioritas



computer vision ?

Computer vision is an **interdisciplinary** field that deals with how computers can be made to gain high-level **understanding** from **digital images or videos**. From the perspective of engineering, it seeks to automate tasks that the human visual system can do.

Computer vision melibatkan banyak disiplin ilmu



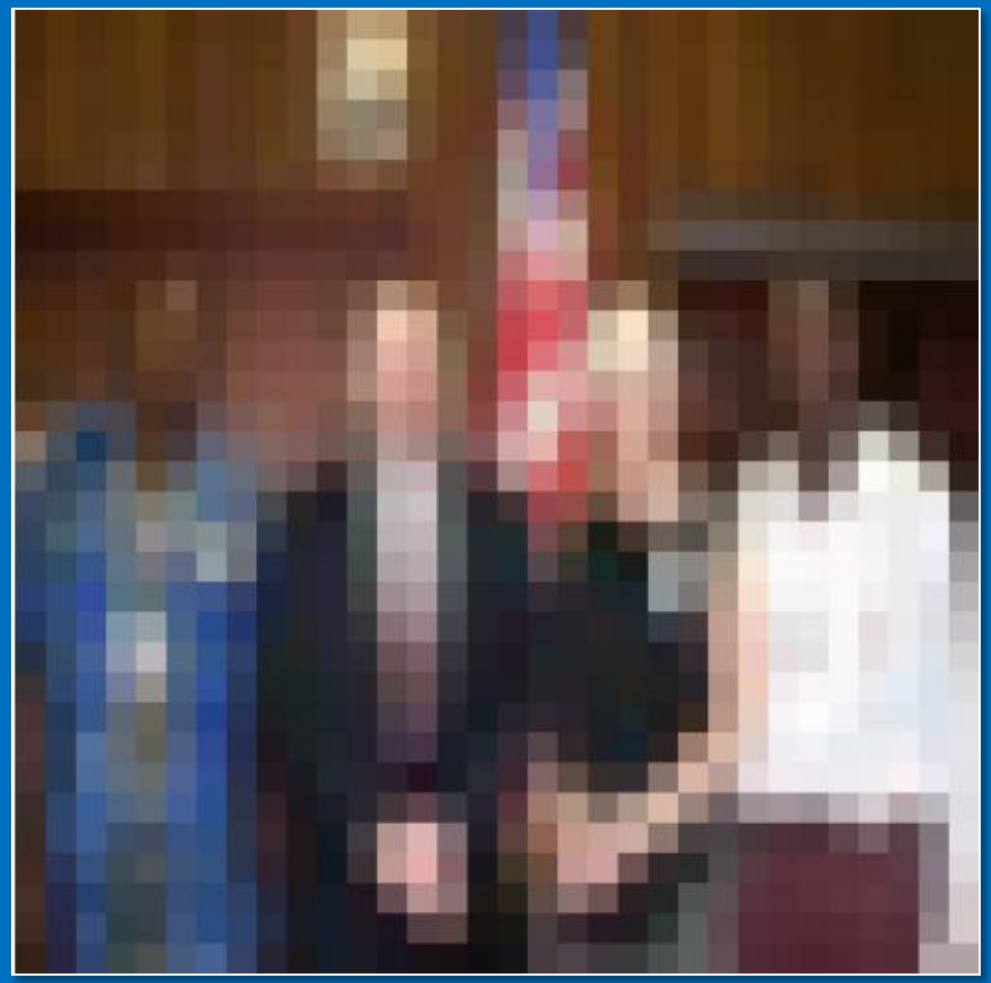
Tujuan utama computer vision : mengekstrak “makna” dari piksel-piksel

Apa yang kita lihat

0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

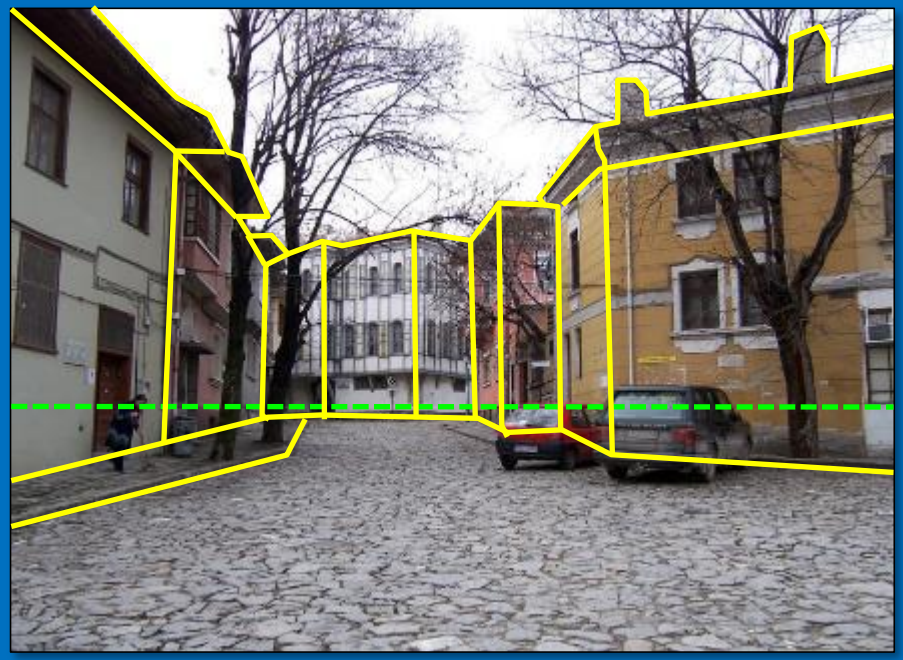
Apa yang komputer lihat

Tujuan utama computer vision : mengekstrak “makna” dari piksel-piksel



Informasi apa saja yang dapat diekstraksi dari sebuah gambar?

Semantic information

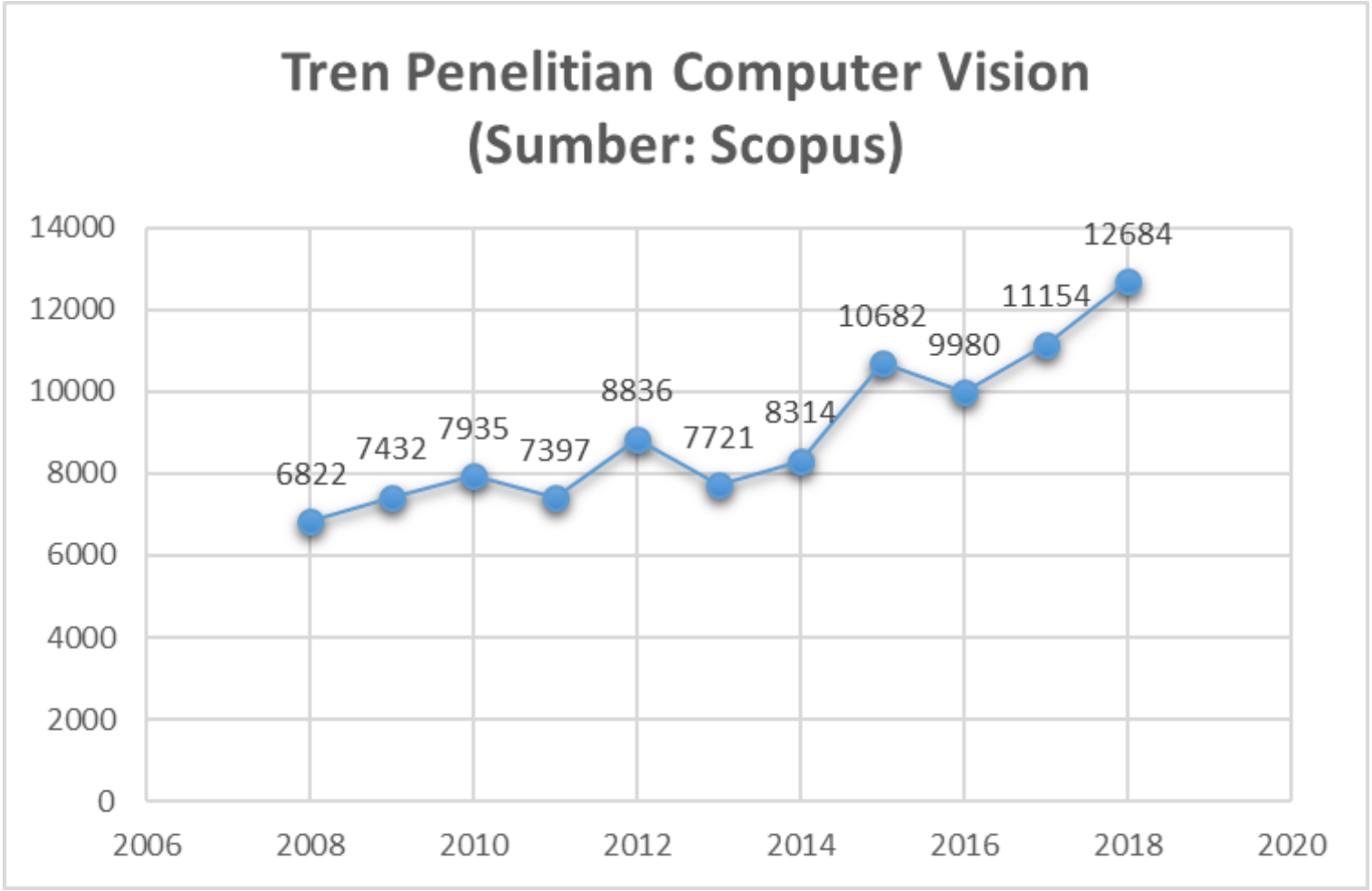


Geometric information

Mengapa belajar computer vision?

- Vision is useful
- Vision is interesting
- Vision is difficult
  - Half of primate cerebral cortex is devoted to visual processing
  - Achieving human-level image understanding is probably “AI-complete”

Penelitian di Bidang Computer Vision



Aplikasi Computer Vision

retail

otomotif

kesehatan

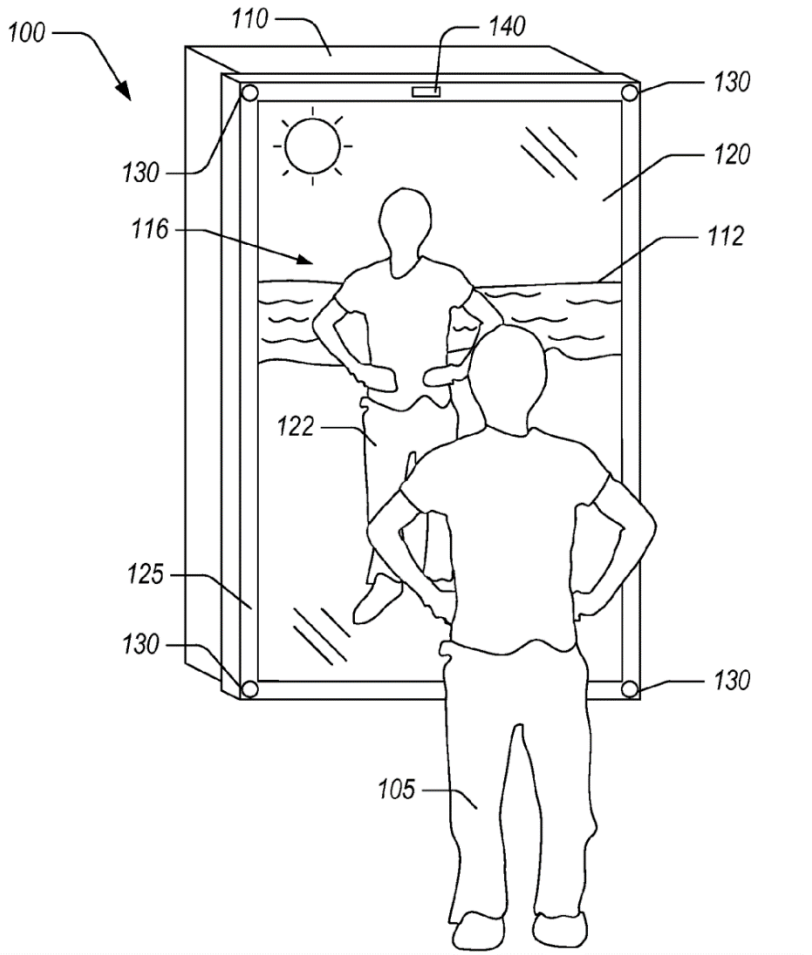
pertanian

perbankan

industri

Amazon Go

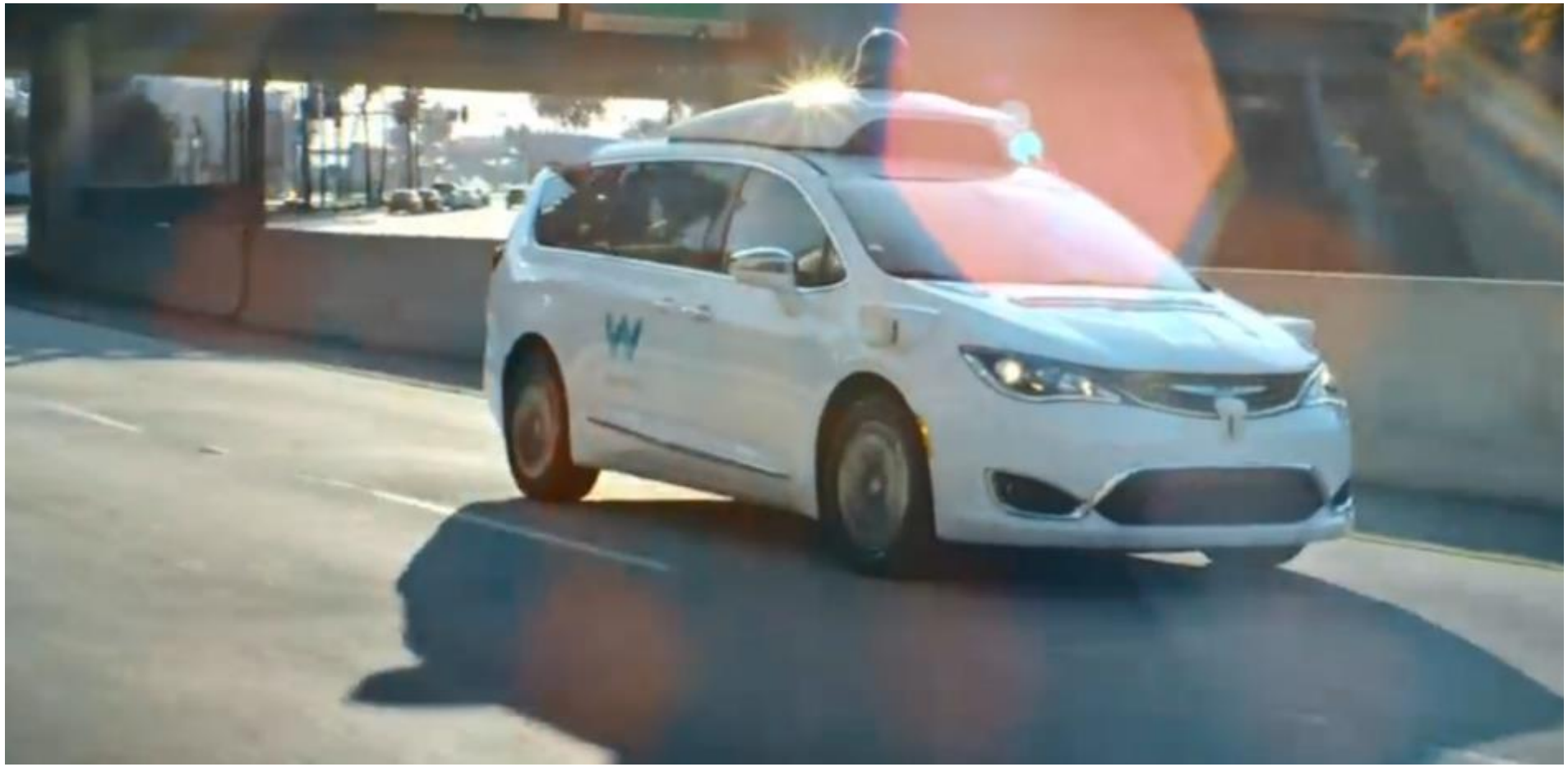
Video : https://www.youtube.com/watch?v=uoKsY9HDk6o&t=6s



virtual mirror technology

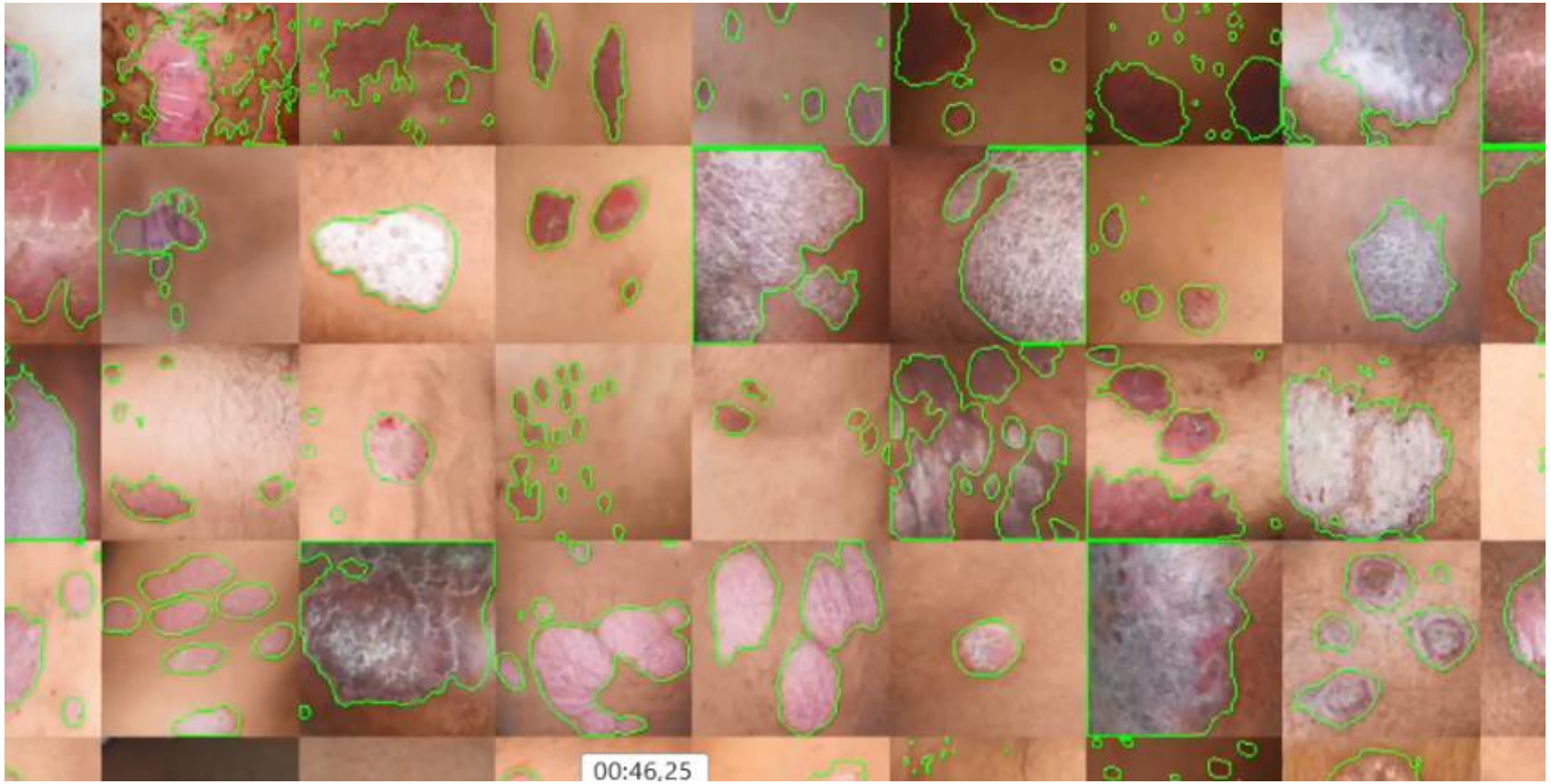
Video: https://www.youtube.com/watch?v=Mr71jrkzWq8

Self-Driving Car Project



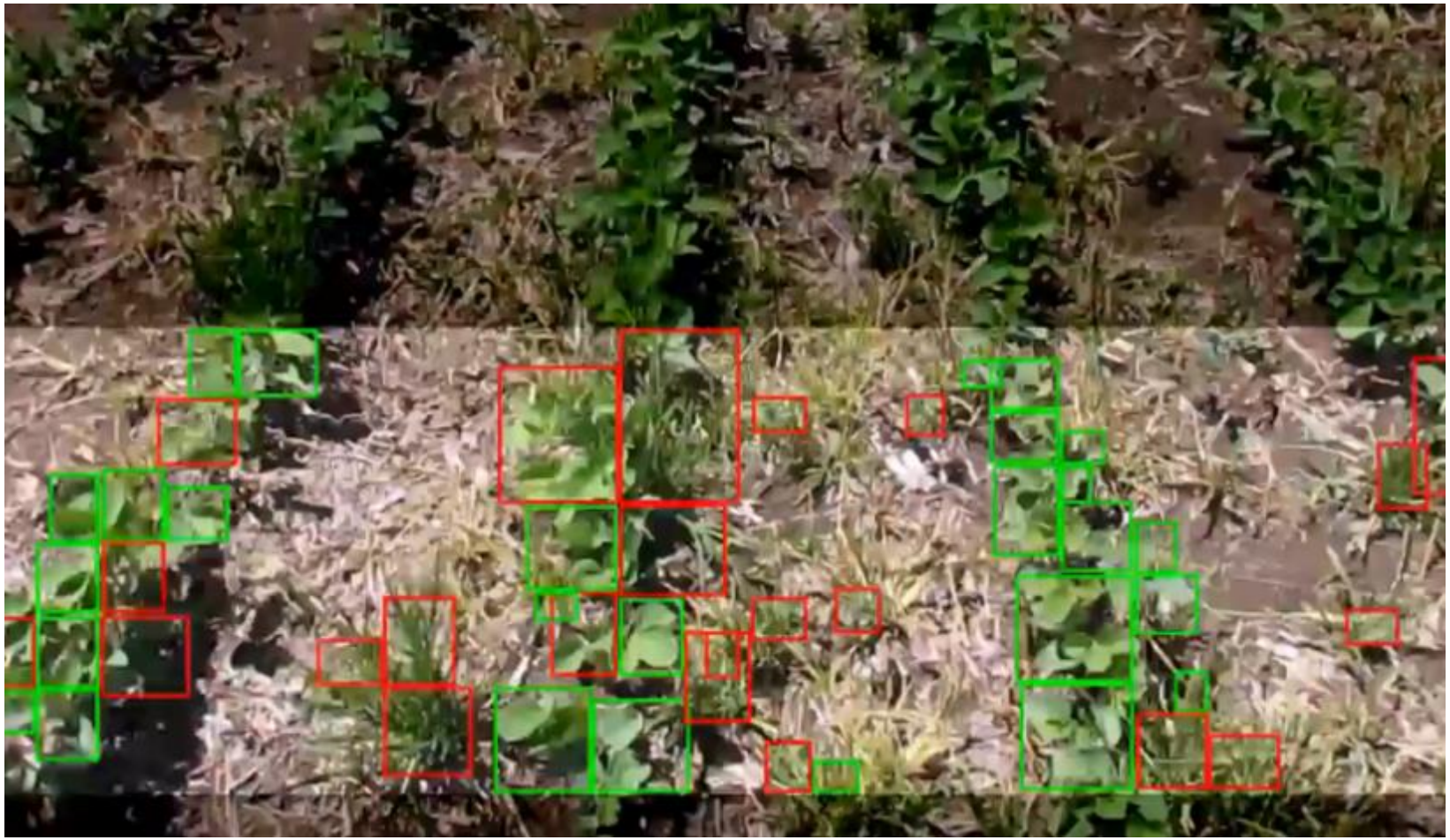
Video: https://www.youtube.com/watch?v=3XB-ygEJ93A

DermLens: recognize psoriasis



Video: https://youtu.be/8UQN8quZXKs

Deteksi rumput



Video: https://www.youtube.com/watch?v=2kSl1QOt96k

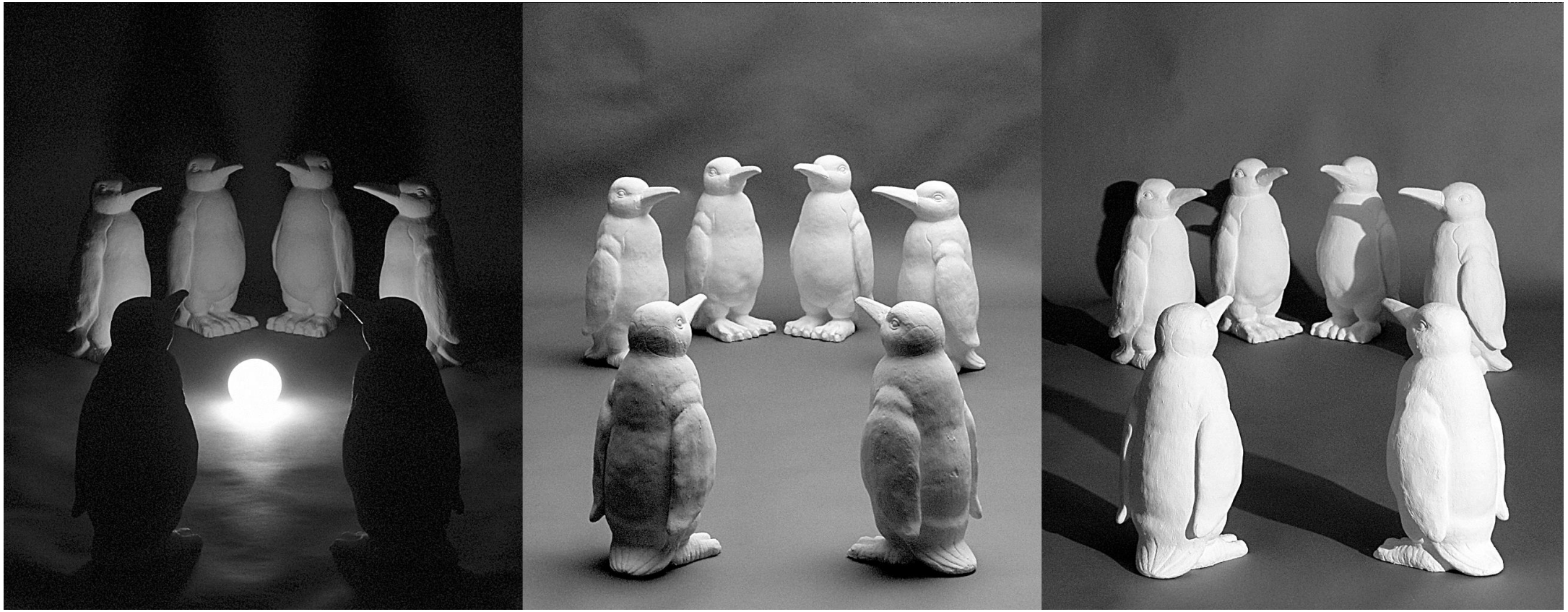
Dan masih banyak contoh lainnya….

- Automated traffic law enforcement
- Intelligent Traffic Lights System
- Face recognition
- Pedestrian detection
- Object detection
- Facial expression
- ….

Tantangan di bidang computer vision

Challenges: viewpoint variation

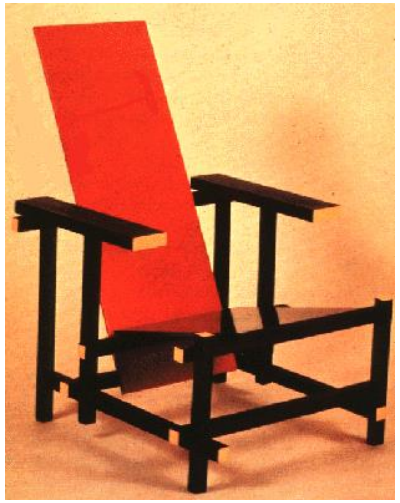
Challenges: illumination



Challenges: scale

Challenges: deformation

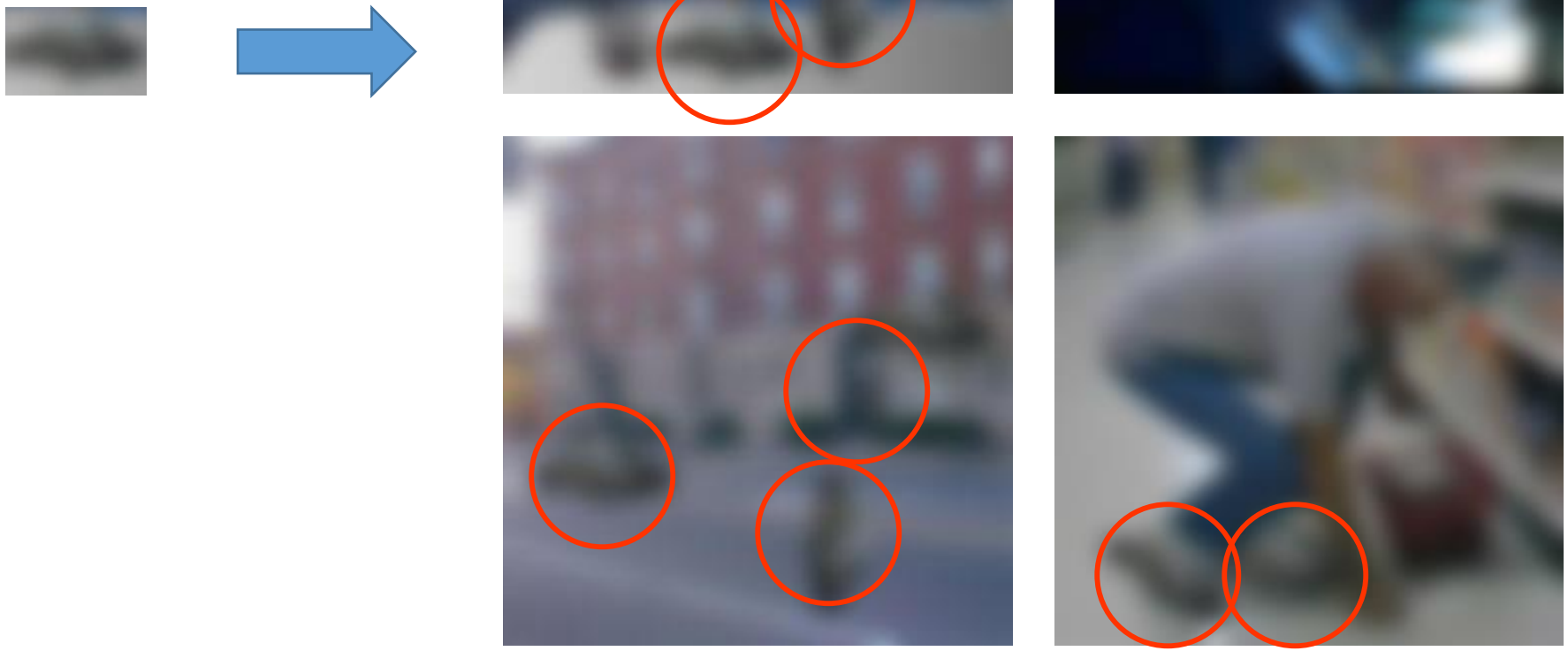
Challenges: object intra-class variation



Challenges: occlusion, clutter

Challenges: Motion

Challenges: ambiguity



slide credit: Fei-Fei, Fergus & Torralba

Challenges: ambiguity

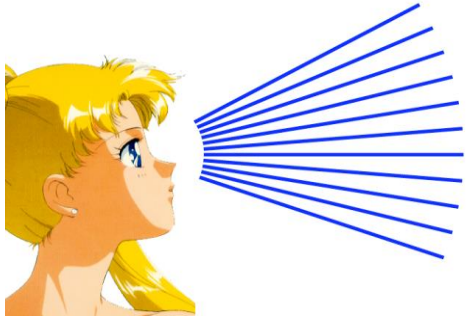
- Many different 3D scenes could have given rise to a particular 2D picture

Challenges or opportunities?

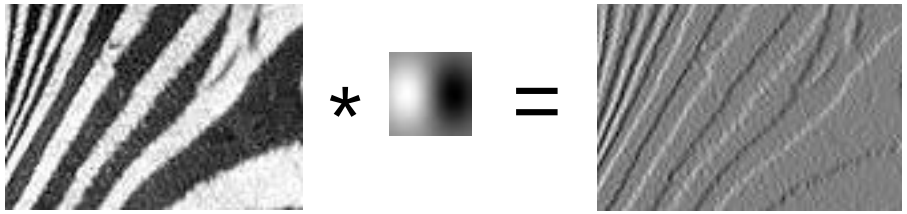
- Images are confusing, but they also reveal the structure of the world through numerous cues
- Our job is to **interpret the cues**!

Bagaimana belajar computer vision ?

1. Pengolahan Citra Digital

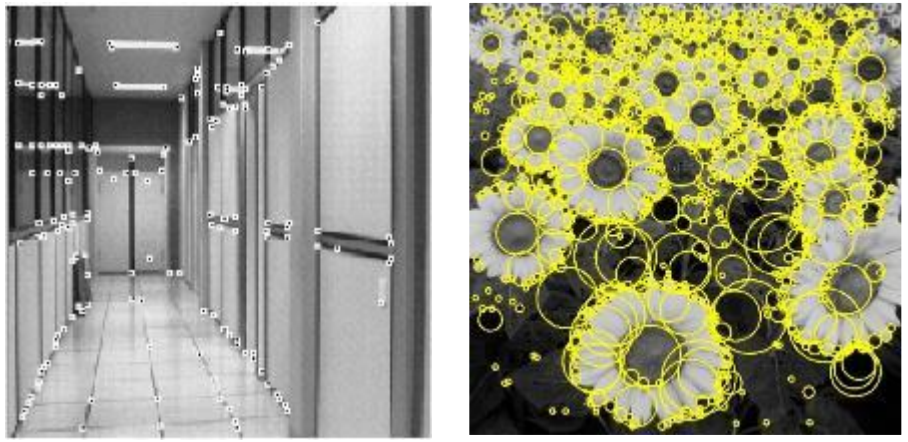


Cameras and sensors
Light and color



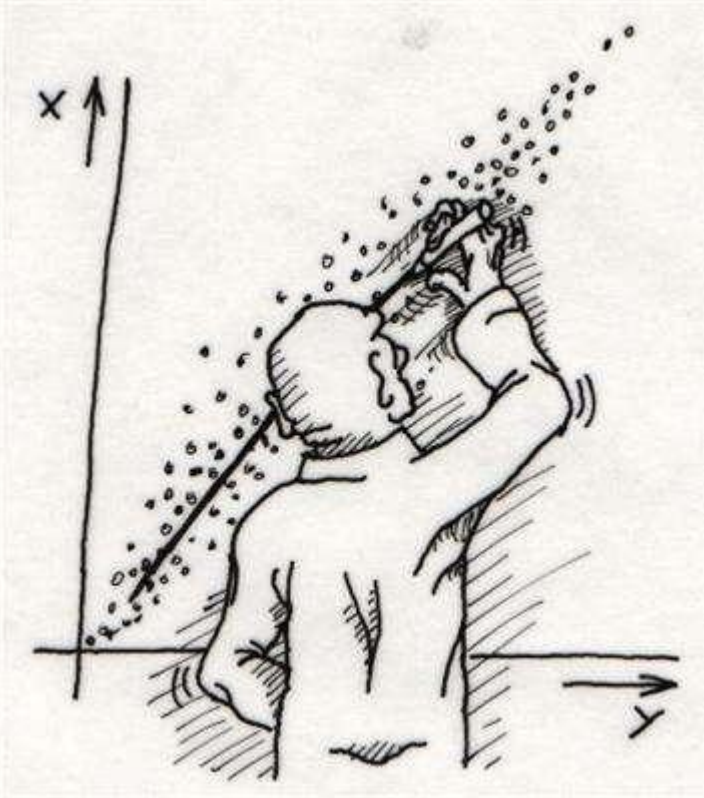
Linear filtering
Edge detection

Image enhancement



Feature extraction, feature tracking

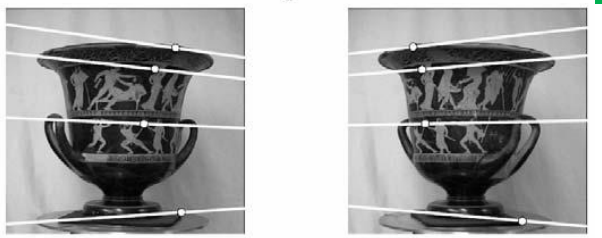
2. Fitting and Grouping



Fitting: Least squares
Hough transform
RANSAC

Alignment

3. Multi-view Geometry

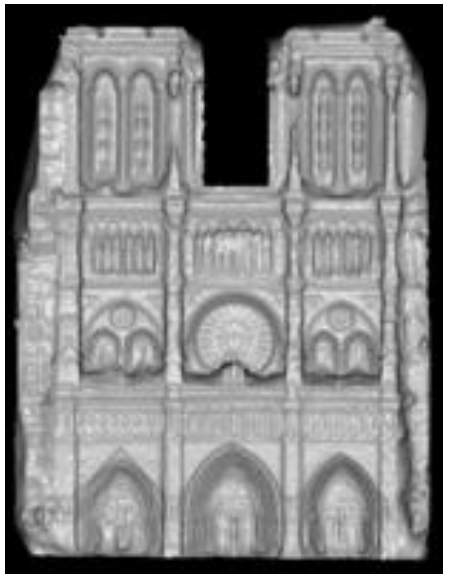


Epipolar geometry

Stereo

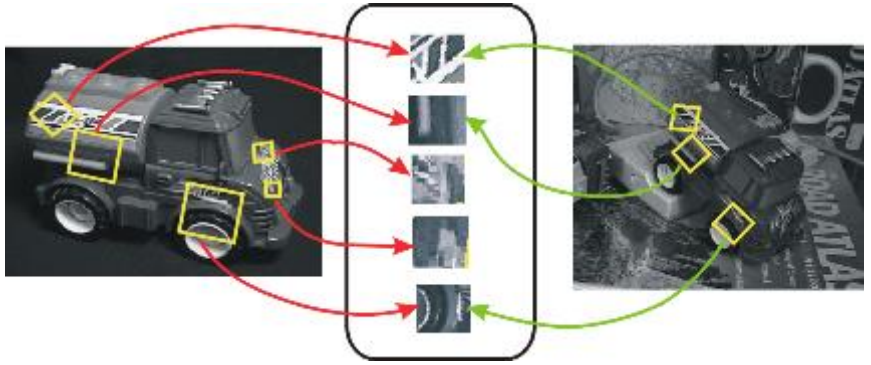
Драконъ, видимый подъ различными углами зрѣнія
По гравюрѣ на мѣди изъ „Oculus artificialis teledioptricus“ Цана. 1702 года.

Structure from motion



3D Photography

Recognition



Instance recognition, large-scale alignment

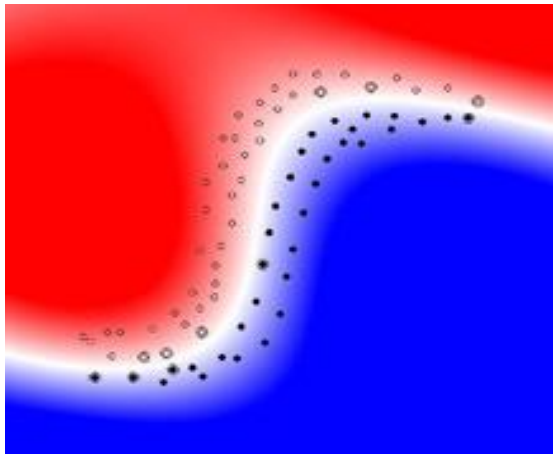
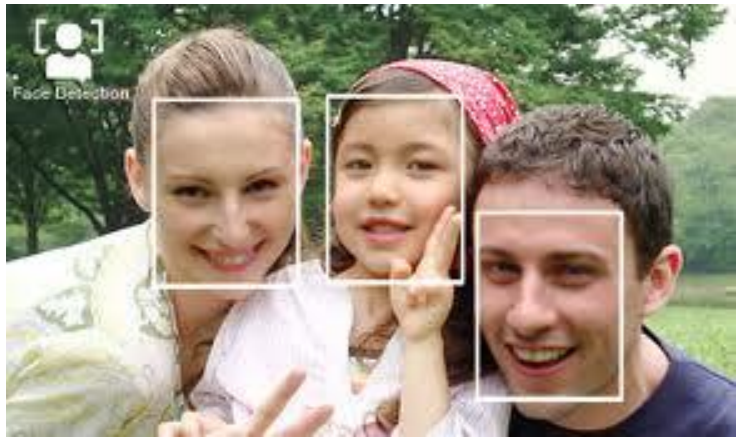


Image classification

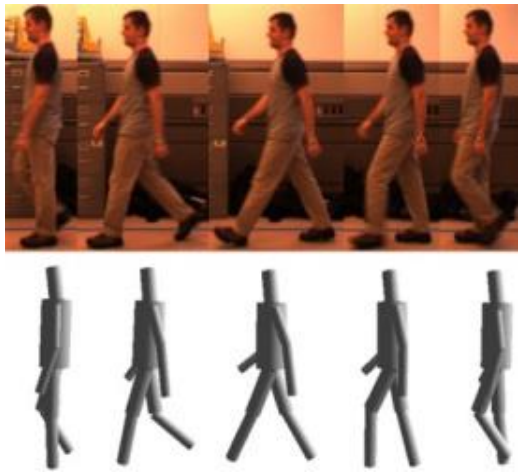


Object detection

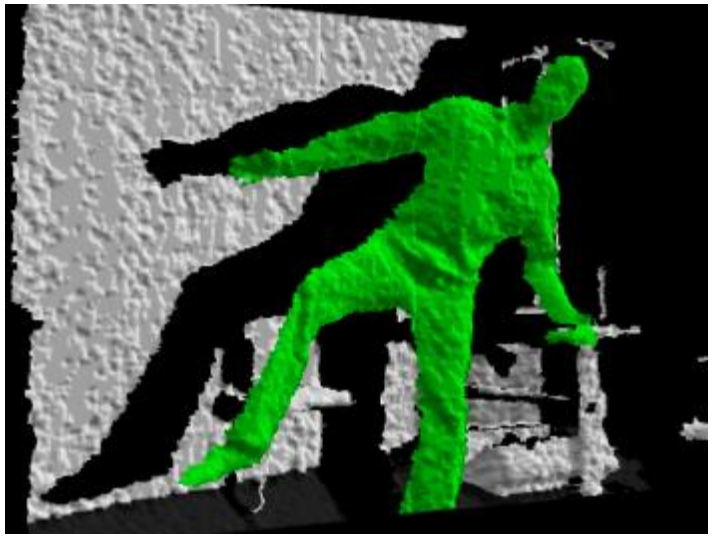
Deep learning

Terus belajar

Segmentation



Video



RGBD images

Images and text

Tools dan Pemrograman

- Fungsi sangat lengkap
- Powerfull
- Standar industri
- Komunitas dan referensi banyak
- Diajarkan di banyak universitas
- Berbayar

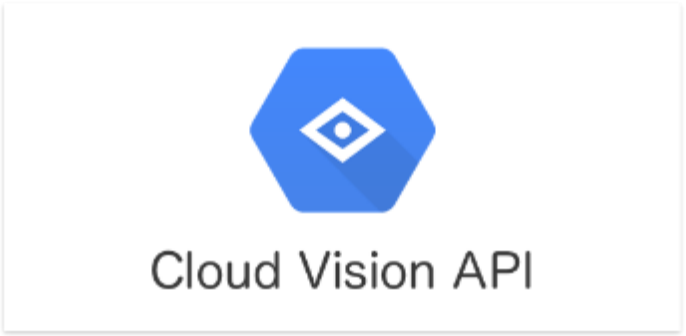
OpenCV (Open Source Computer Vision Library) is released under a BSD license and hence it’s free for both academic and commercial use. It has C++, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. Written in optimized C/C++, the library can take advantage of multi-core processing.

Tools dan Pemrograman

GNU Octave is a high-level language, primarily intended for numerical computations. It provides a convenient command line interface for solving linear and nonlinear problems numerically, and for performing other numerical experiments using a language that is mostly compatible with Matlab. It may also be used as a batch-oriented language.

GNU Octave is also freely redistributable software. You may redistribute it and/or modify it under the terms of the GNU General Public License (GPL) as published by the Free Software Foundation.

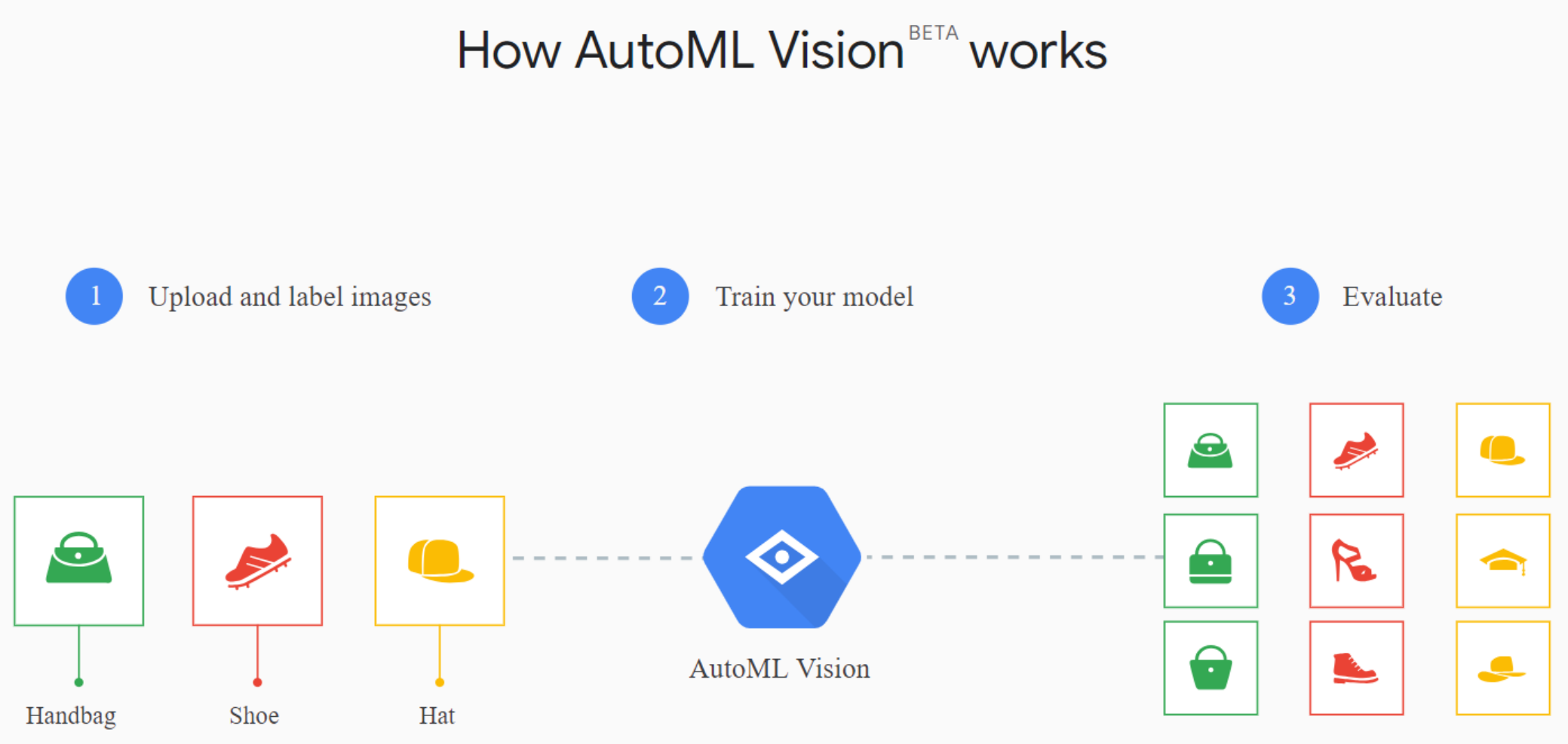
Tools dan Pemrograman



https://cloud.google.com/vision/

Google Cloud Vision API enables developers to perform image processing by encapsulating powerful machine learning models in a simple REST API that can be called in an application. Also, its Optical Character Recognition (OCR) functionality enables you to detect text in your images.

Tools dan Pemrograman



Tools dan Pemrograman

Amazon Rekognition makes it easy to add image and video analysis to your applications. You just provide an image or video to the Rekognition API, and the service can identify the objects, people, text, scenes, and activities, as well as detect any inappropriate content. Amazon Rekognition also provides highly accurate facial analysis and facial recognition on images and video that you provide. You can detect, analyze, and compare faces for a wide variety of user verification, people counting, and public safety use cases.

https://aws.amazon.com/rekognition/

Tools dan Pemrograman

Microsoft Azure Computer Vision API
https://azure.microsoft.com/en-in/services/cognitive-services/computer-vision/

Extract rich information from images to categorize and process visual data—and perform machine-assisted moderation of images to help curate your services.

“Semakin banyak yang kita pelajari,
semakin menunjukkan kebesaran,
karunia dan kuasa Tuhan”

فَبِأَيِّ ءَالَآءِ رَبِّكُمَا تُكَذِّبَانِ ﴿٥٥﴾

Maka nikmat Tuhan kamu yang manakah
yang kamu dustakan?

Referensi

- Making Indonesia 4.0 - http://www.kemenperin.go.id/download/18384
- Beberapa slide berdasarkan materi Computer Vision dari Universitas Illinois - http://slazebni.cs.illinois.edu/spring16
- https://hub.packtpub.com/top-10-computer-vision-tools/
- https://en.wikipedia.org/wiki/Computer_vision
- Beberapa gambar diambil melalui situs pencari Google.

Terima Kasih

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slideshare.net/achmatim http://achmatim.net