LECTURER: TAI LE QUY

ARTIFICIAL INTELLIGENCE

TOPIC OUTLINE

History of Artificial Intelligence 1

Early Systems in Artificial Intelligence 2

Neuroscience and Cognitive Science 3

Modern Artificial Intelligence Systems 4

Applications of Artificial Intelligence 5

UNIT 4.3

MODERN ARTIFICIAL INTELLIGENCE SYSTEMS

STUDY GOALS

On completion of this unit, you will have…

- … understanding of basic components within Natural Language Processing (NLP) components.
- … knowledge of main steps within Computer Vision (CV) applications.
- … a basic idea of common features extracted from images.

EXPLAIN SIMPLY

1. Describe the concept of stemming within NLP using your own words with the example of change.
2. Explain the relation between AI, ML and Computer Vision.
3. Can you list some of the typical features used within Computer Vision?

NATURAL LANGUAGE PROCESSING (NLP)

Speech recognition

identification of words in spoken language

Language understanding

extraction of meaning from words and sentences, and reading comprehension

Language generation

ability to express information

NATURAL LANGUAGE PROCESSING (NLP)

Speech recognition

Virtual assistants

Language understanding

Spam classification

Sentiment analysis

Language generation

Summaries

Chatbots

NATURAL LANGUAGE PROCESSING (NLP)

- Virtual assistants on commercial phones and laptop computers
- Machine translations between two different human languages, commercially available smartphones, tablets or notebooks
- Key-word extraction to analyze volumes of text, for example, to assist with media reporting
- Sentiment analysis to e-mail and social media texts to assess the writer’s mood and emotional attitude towards the subject
- Voice-recognition software to identify speakers
- Speech-recognition software to recognize words measured by the accuracy
- Rate and how well the system can keep up with an ongoing conversation in real time

NATURAL LANGUAGE PROCESSING (NLP)

- Alan Turing (1950) proposed this test as a way of determining whether a machine could be considered intelligent
- Natural language processing, as a technical discipline, started in the mid-1950s during a time of heightened geopolitical tension between the United States and the former Soviet Union (English and Russian translators)
- Computing power increased in line with Moore’s Law
- The first wave of language models was characterized by a grammar-oriented approach
- Part-of-speech tagging: use Markov model to describe a dynamic system like speech

Semantics

Pen = writing tool

Semantics

Word stemming

{Change, changing, changer, changed} = **change**

NLP COMPONENTS

Semantics

Word stemming

Part-of-speech-recognition

I	**like**	**reading**	**books**
Pronoun	*Verb*	*Verb*	*Noun*

NLP COMPONENTS

Semantics	Word stemming	Part-of-speech-recognition	Named entities recognition (NER)

Jane Doe is studying at IU since 2020.

Person *Org* *Date*

NLP COMPONENTS

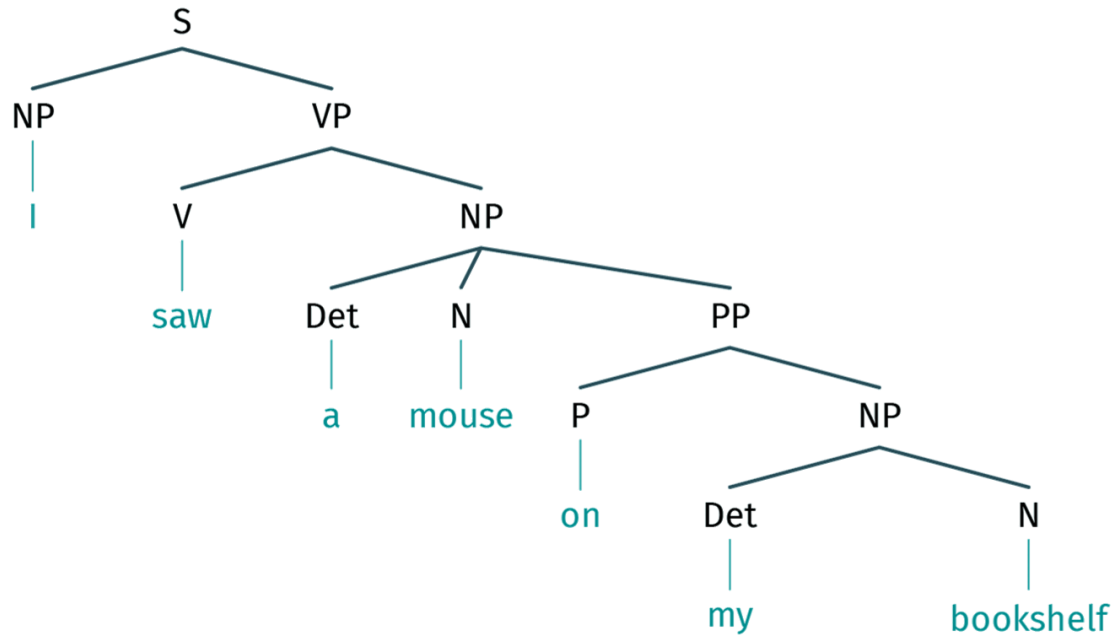
Semantics

Word stemming

Part-of-speech-recognition

Named entities recognition (NER)

Parsing



Source of the graphic: IU International University, Course Book DLMAIAI01.

NLP COMPONENTS

Semantics

Word stemming

Part-of-speech-recognition

Named entities recognition (NER)

Parsing

Sentiment analysis

The product is good.

The product can be improved.

The product is useless.

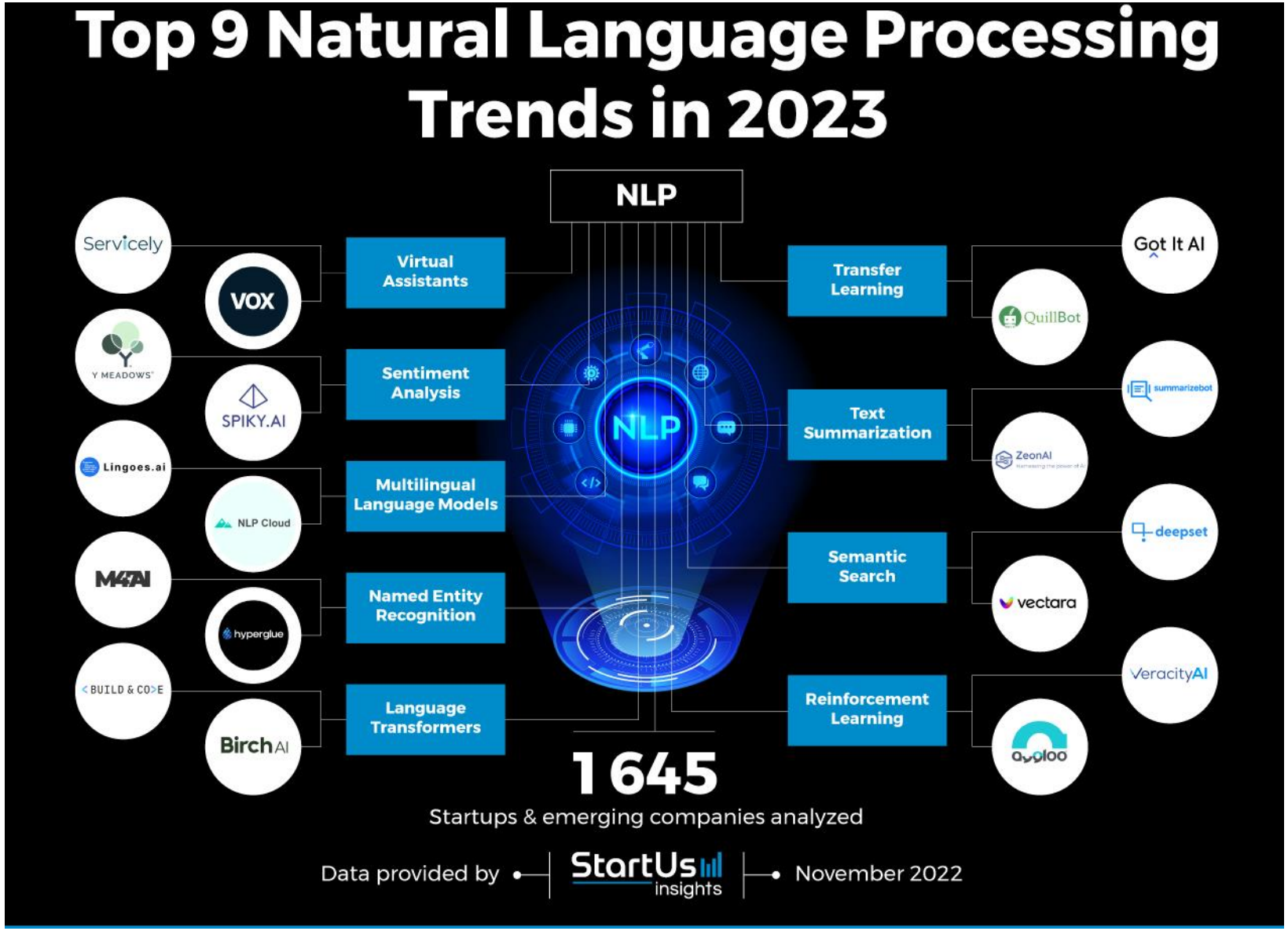
NLP COMPONENTS

Semantics	Word stemming	Part-of-speech-recognition	Named entities recognition (NER)
Parsing	Sentiment analysis	Question and answering	

Question: Who was the first president of the United States?

Answer: George Washington

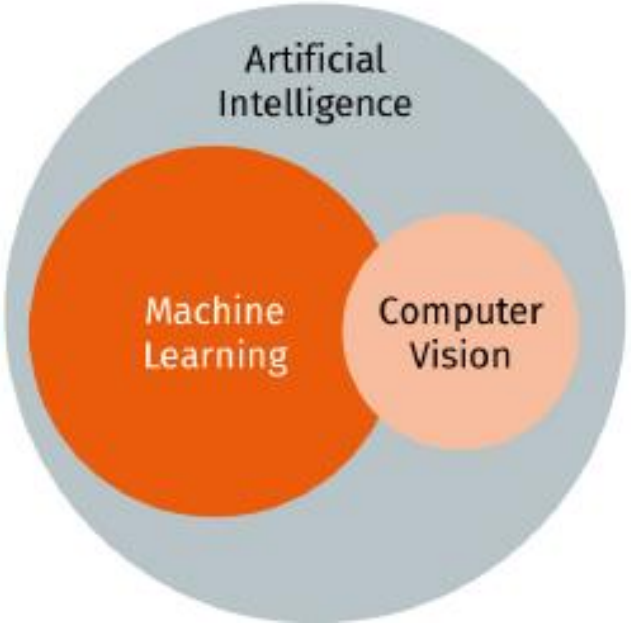
NLP



Source of image: https://www.startus-insights.com/innovators-guide/natural-language-processing-trends/

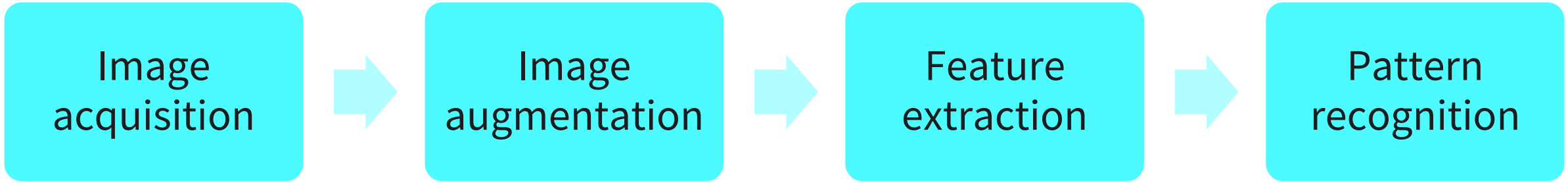
COMPUTER VISION

Computer vision aims to help computers see and understand the content of images just as well as humans do if not also in some cases even better than humans do.



Source of image: Course book

Computer Vision = understand the content of images and videos



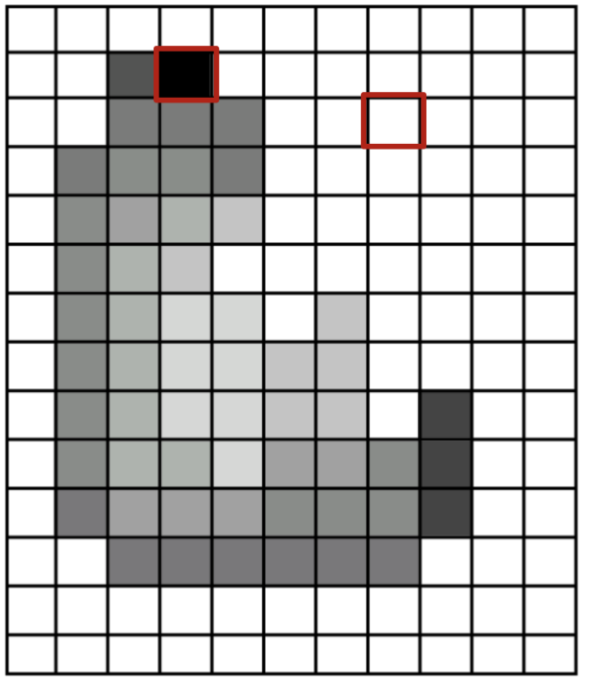
- Camera vision
- Pinhole cameras
- Film cameras
- Digital cameras

- Image sharpening
- Contrast enhancement

- Extract higher-level image features

- Infer meaningful image content

- PIXEL: pix (pictures) + el (element)



=

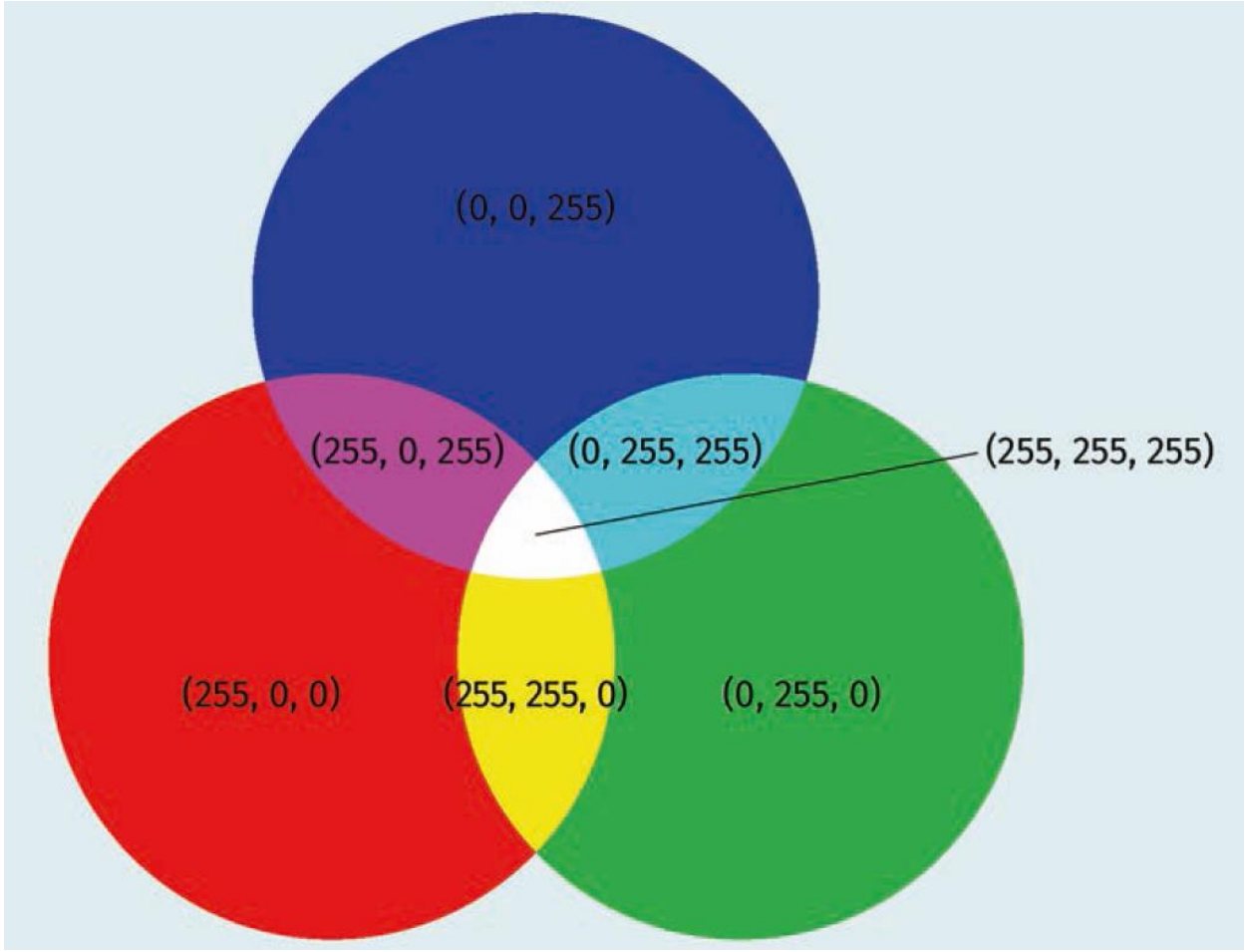
255	255	255	255	255	255	255	255	255	255	255
255	255	20	0	255	255	255	255	255	255	255
255	255	75	75	255	255	255	255	255	255	255
255	75	95	95	75	255	255	255	255	255	255
255	96	127	145	175	255	255	255	255	255	255
255	127	145	175	175	175	255	255	255	255	255
255	127	145	200	200	175	175	95	255	255	255
255	127	145	200	200	175	175	95	47	255	255
255	127	145	145	175	127	127	95	47	255	255
255	74	127	127	127	95	95	95	47	255	255
255	255	74	74	74	74	74	74	255	255	255
255	255	255	255	255	255	255	255	255	255	255
255	255	255	255	255	255	255	255	255	255	255
255	255	255	255	255	255	255	255	255	255	255

0 = black; 255 = white

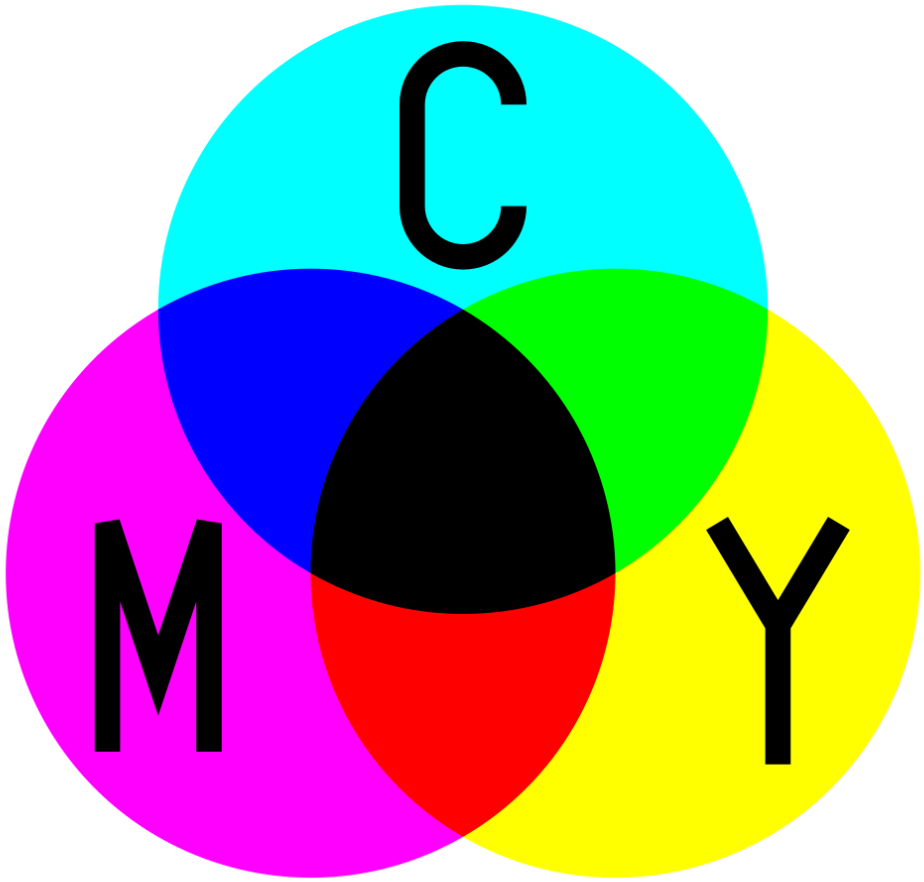
Source of image: https://edtech.engineering.utoronto.ca/files/2d-image-digital-representation

COLOR REPRESENTATION

RGB

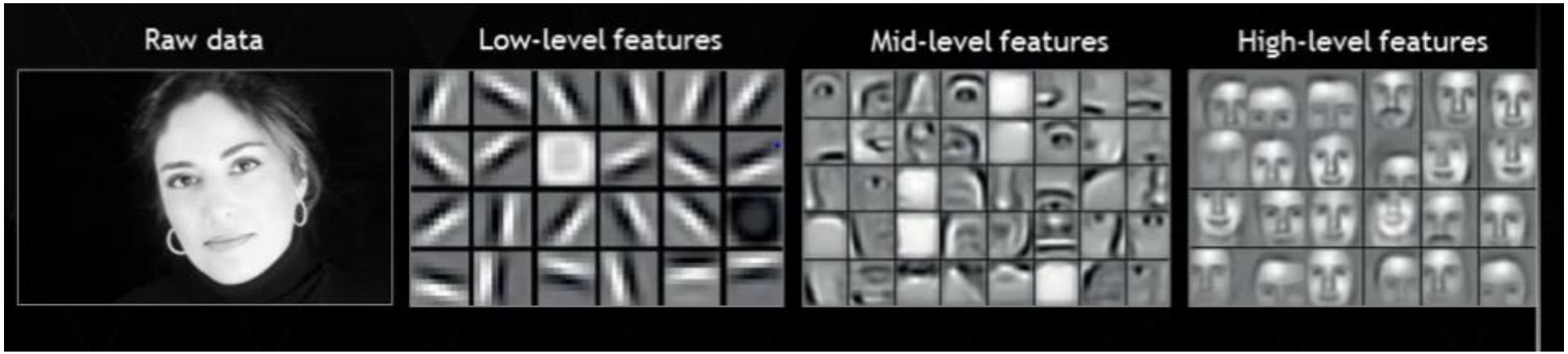


CMYK



Source of iamges: wikipedia

Extract salient features from images such as edges, colors, blobs and ridges:

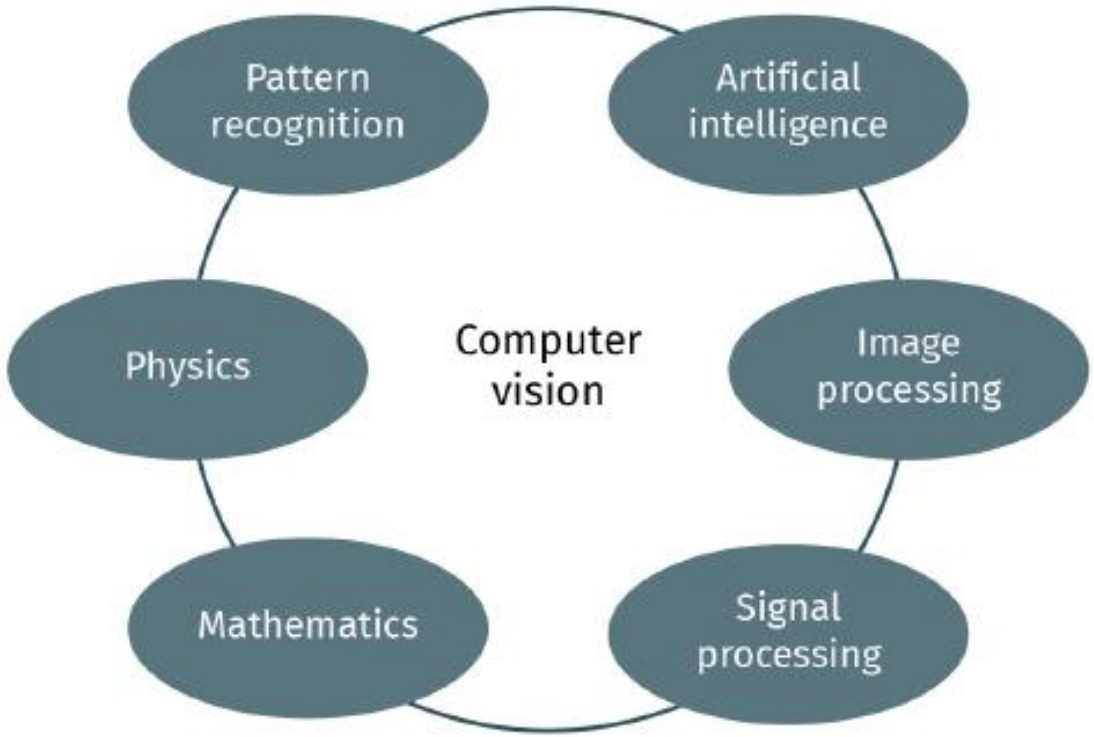


Source of the image: Tomodan & Caleanu, 2018.

COMPUTER VISION DEMO

Source of the video: YouTube, 2018, https://www.youtube.com/watch?v=G2VaJvNNp4k.

COMPUTER VISION



Source of iamge: Course book

You now have…

- … understanding of basic components within Natural Language Processing (NLP) components.
- … knowledge of main steps within Computer Vision (CV) applications.
- … a basic idea of common features extracted from images.

SESSION 5

TRANSFER TASK

TRANSFER TASK

Brainstorm about factors of images that make Computer Vision difficult. While doing so, reflect on Human Vision throughout daily life and what information the human brain needs to translate.

TRANSFER TASK
PRESENTATION OF THE RESULTS

Please present your results.

The results will be discussed in plenary.

1. Speech-to-Text
   a) has no relation to natural language processing.
   b) is one of many sub-fields of natural language processing.
   c) is what natural language processing is all about.
   d) has no practical application.

2. Artificial General Intelligence
   a) is a natural extension of weak artificial intelligence.
   b) is provably impossible.
   c) will require a considerably more variegated set of abilities than what weak artificial intelligence approaches can currently provide.
   d) is guaranteed to come about in the near future.

3. Computer vision refers to
   a) image acquisition by computers.
   b) computer graphics.
   c) the semantic understanding of visual scenes.
   d) filter operations such as smoothing or de-noising.

LIST OF SOURCES

Tomodan, E.R. & Caleanu, C. (2018). *Bag of Features vs Deep Neural Networks for Face Recognition*. 2018 International Symposium on Electronics and Telecommunications (ISETC). DOI: 10.1109/ISETC.2018.8583846.