

Algorithms and AI systems demystified

UNDERSTANDING ARTIFICIAL INTELLIGENCE



Maarten Van den Broeck

Senior Content Developer at DataCamp

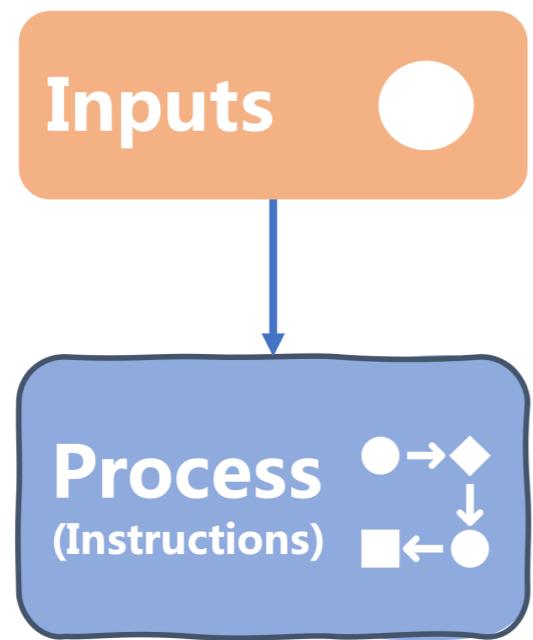
What is an algorithm?

Algorithm: a set of (computer) instructions to solve a problem or perform an action

Inputs

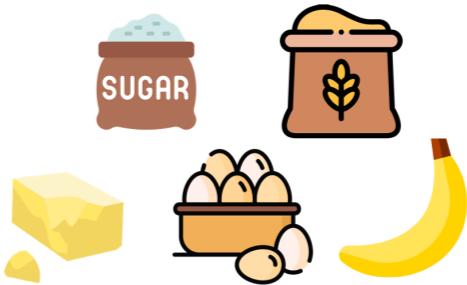
What is an algorithm?

Algorithm: a set of (computer) instructions to solve a problem or perform an action

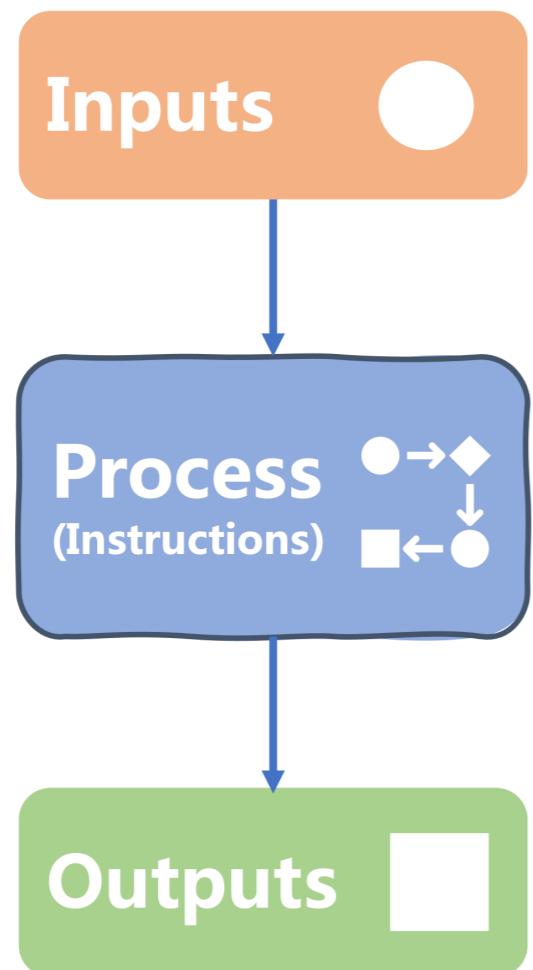


What is an algorithm?

Algorithm: a set of (computer) instructions to solve a problem or perform an action

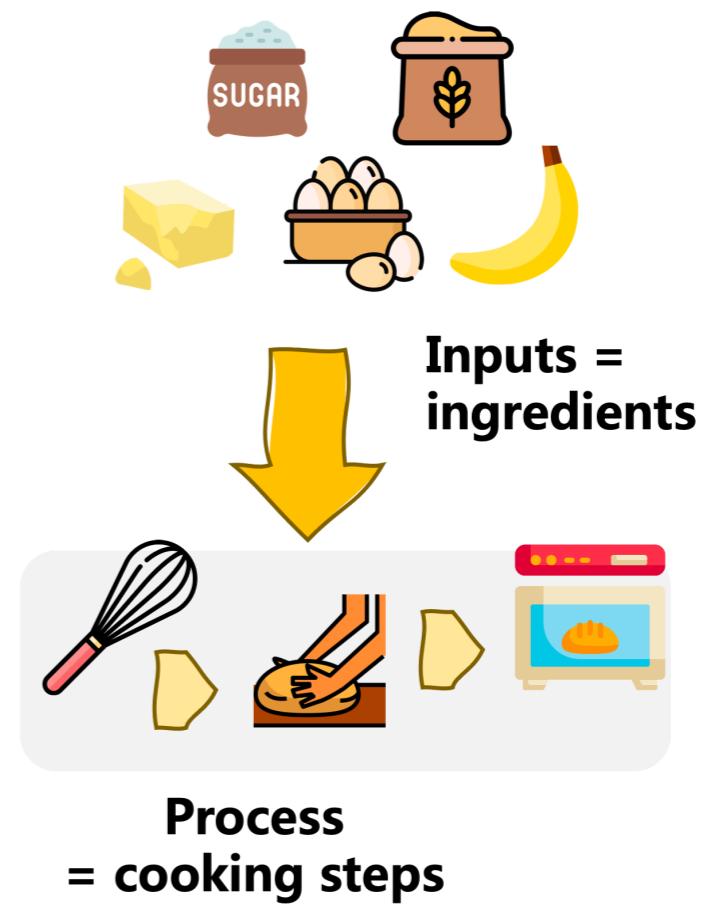
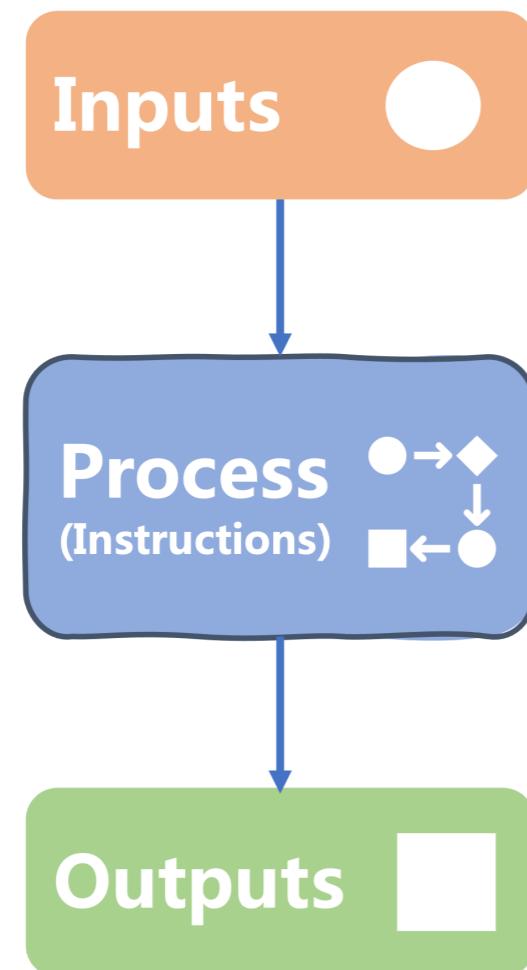


Inputs = ingredients



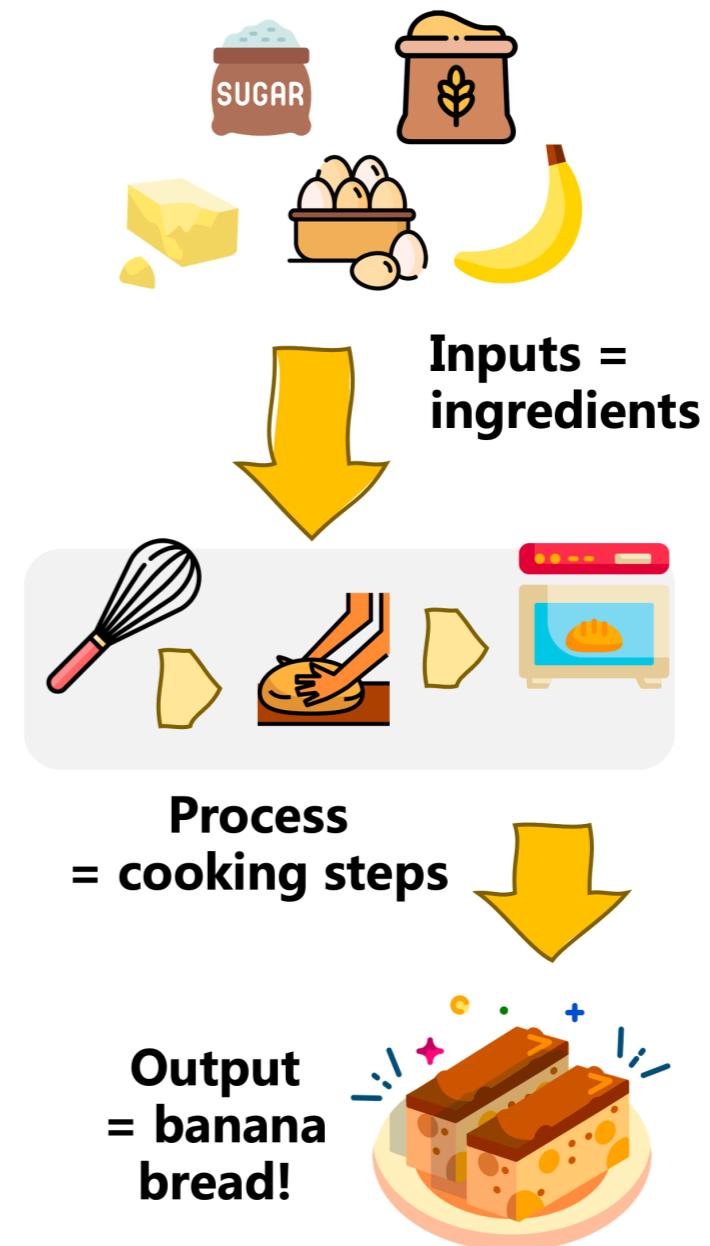
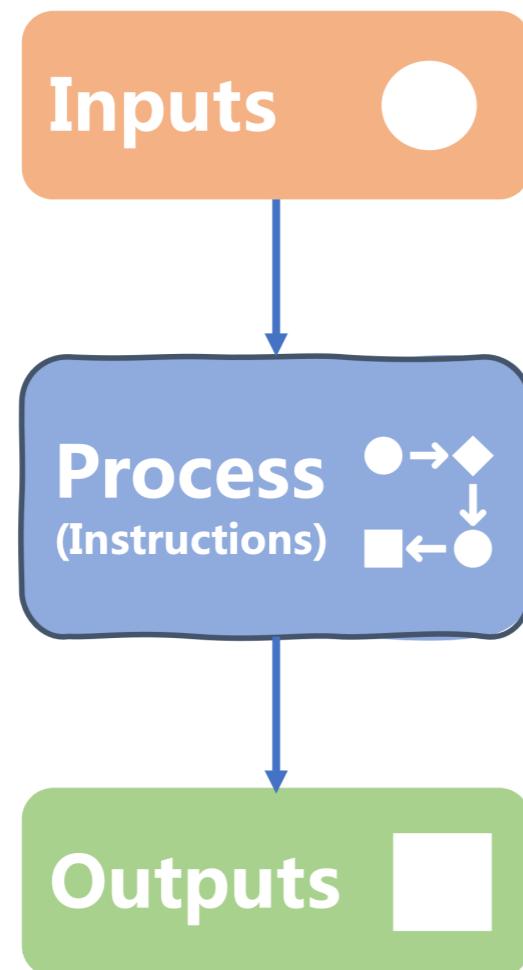
What is an algorithm?

Algorithm: a set of (computer) instructions to solve a problem or perform an action

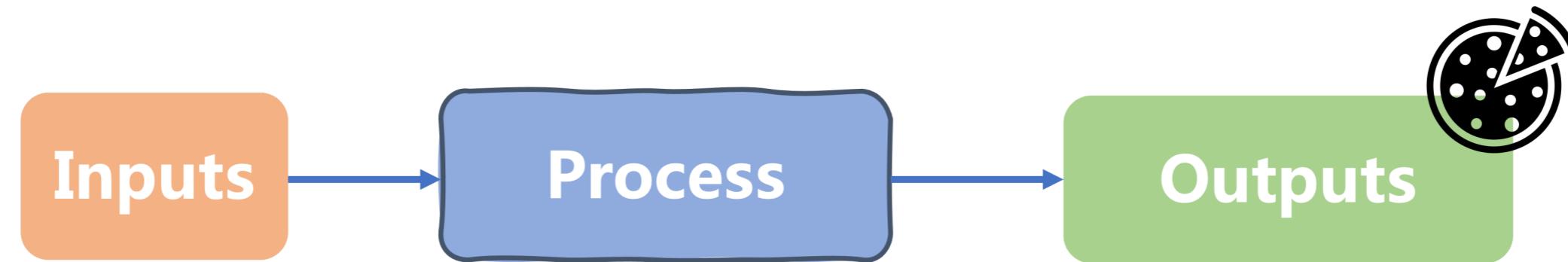


What is an algorithm?

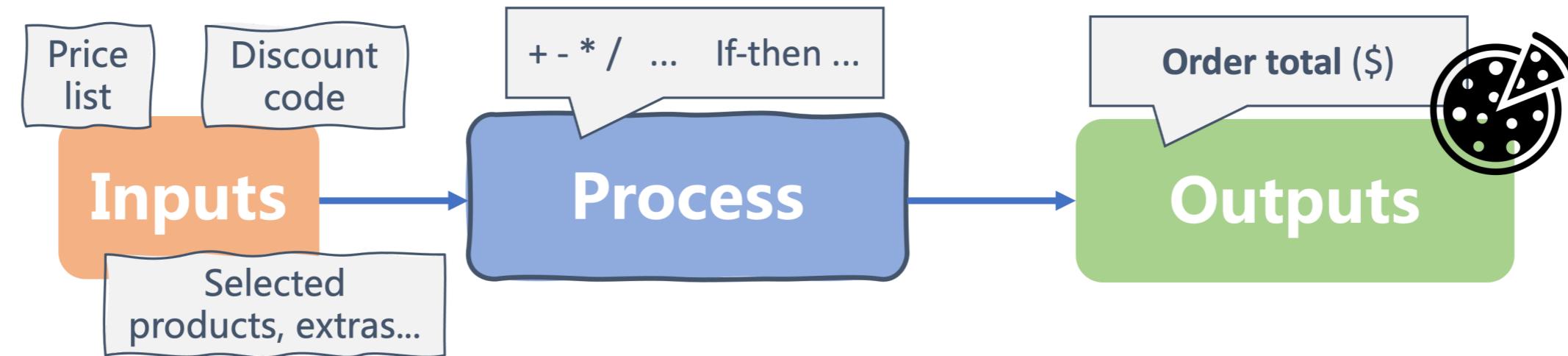
Algorithm: a set of (computer) instructions to solve a problem or perform an action



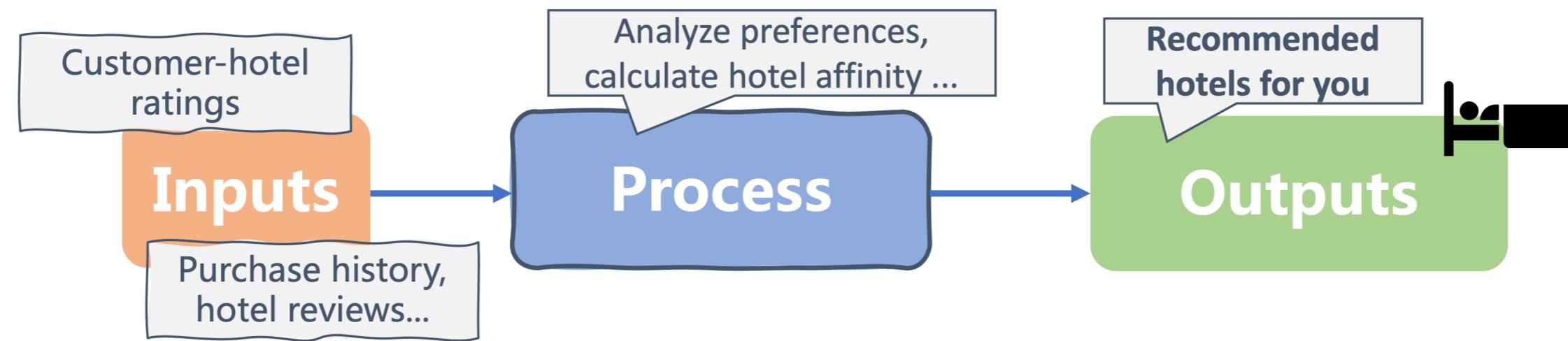
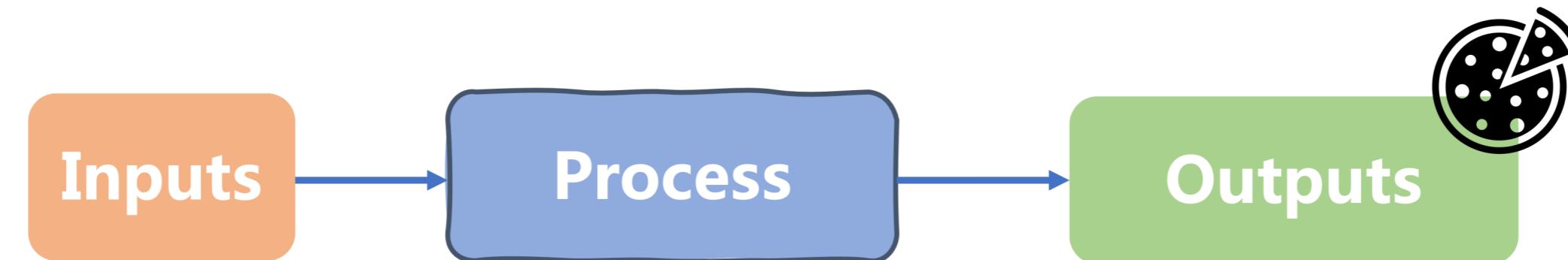
Algorithms in Computer Science vs AI algorithms



Algorithms in Computer Science vs AI algorithms



Algorithms in Computer Science vs AI algorithms



- **AI algorithms:** learn by themselves to produce better outputs or processes from input data

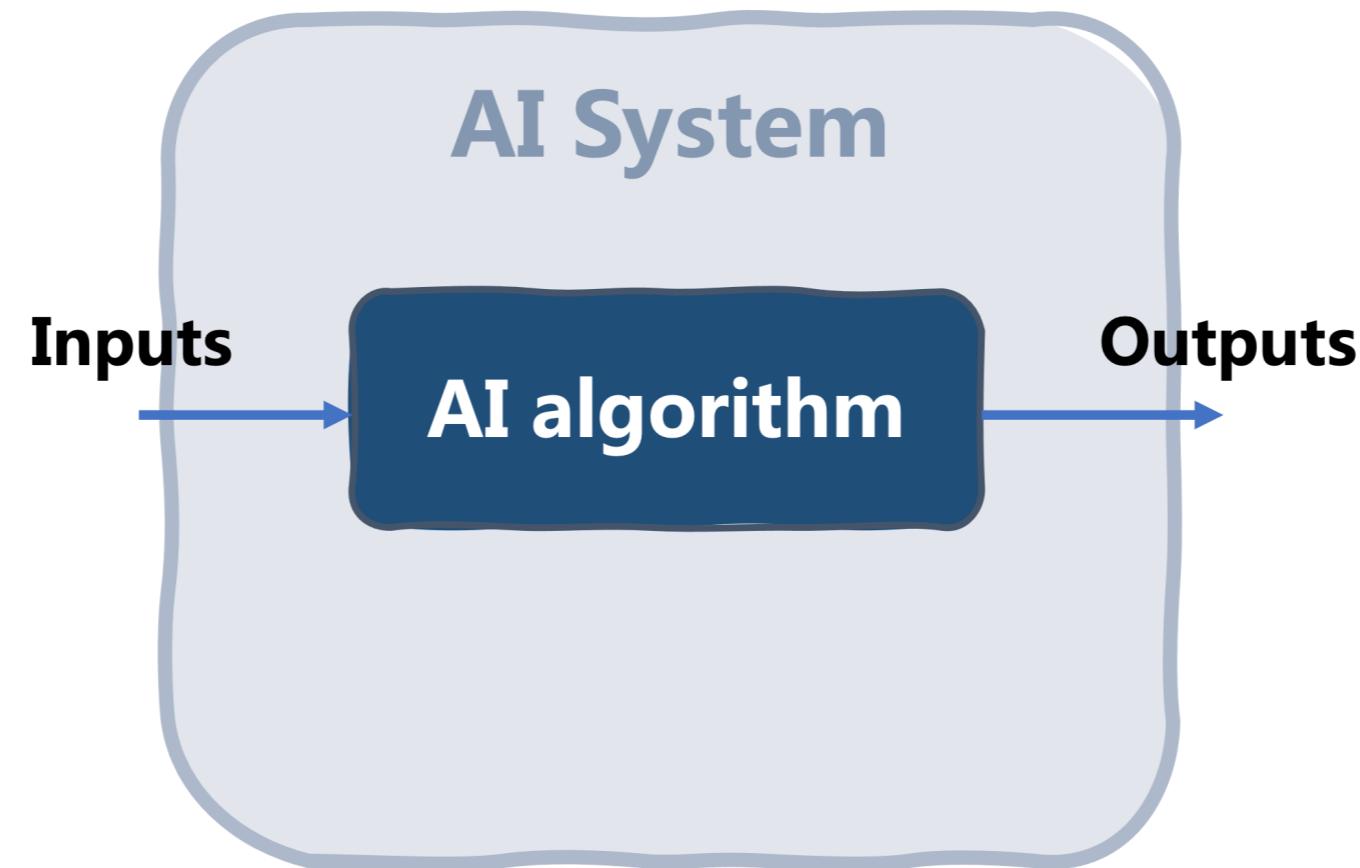
What is an AI system?

AI system: infrastructure and components needed to implement and deploy AI algorithms in the real world



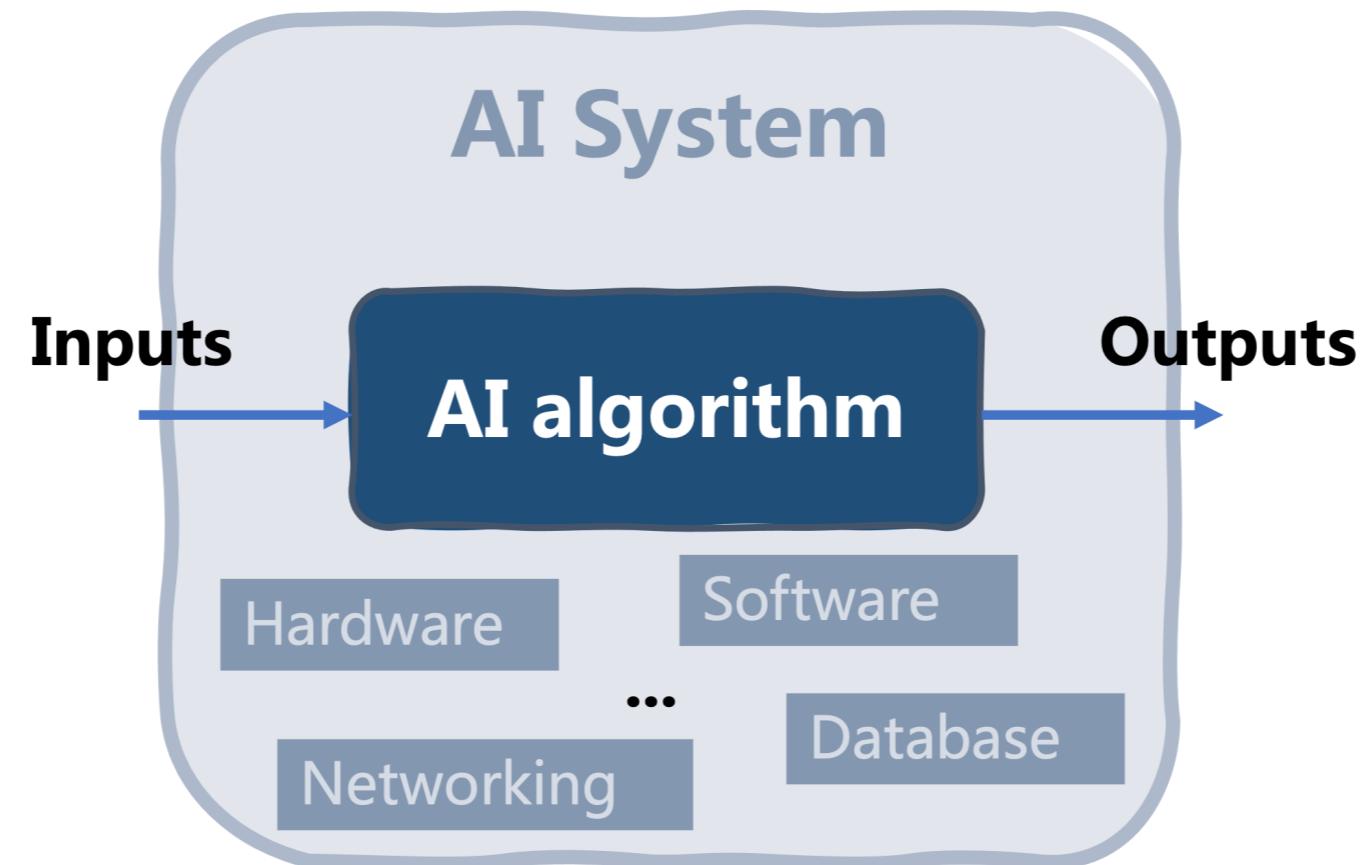
What is an AI system?

AI system: infrastructure and components needed to implement and deploy AI algorithms in the real world



What is an AI system?

AI system: infrastructure and components needed to implement and deploy AI algorithms in the real world



Let's practice!

UNDERSTANDING ARTIFICIAL INTELLIGENCE

Acquiring data

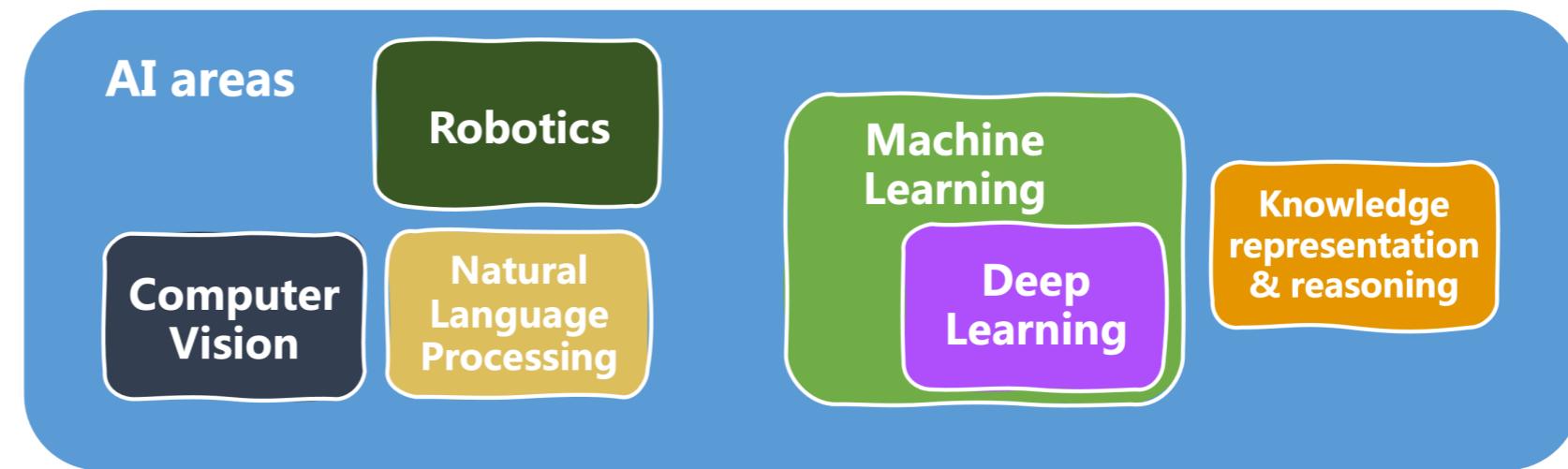
UNDERSTANDING ARTIFICIAL INTELLIGENCE



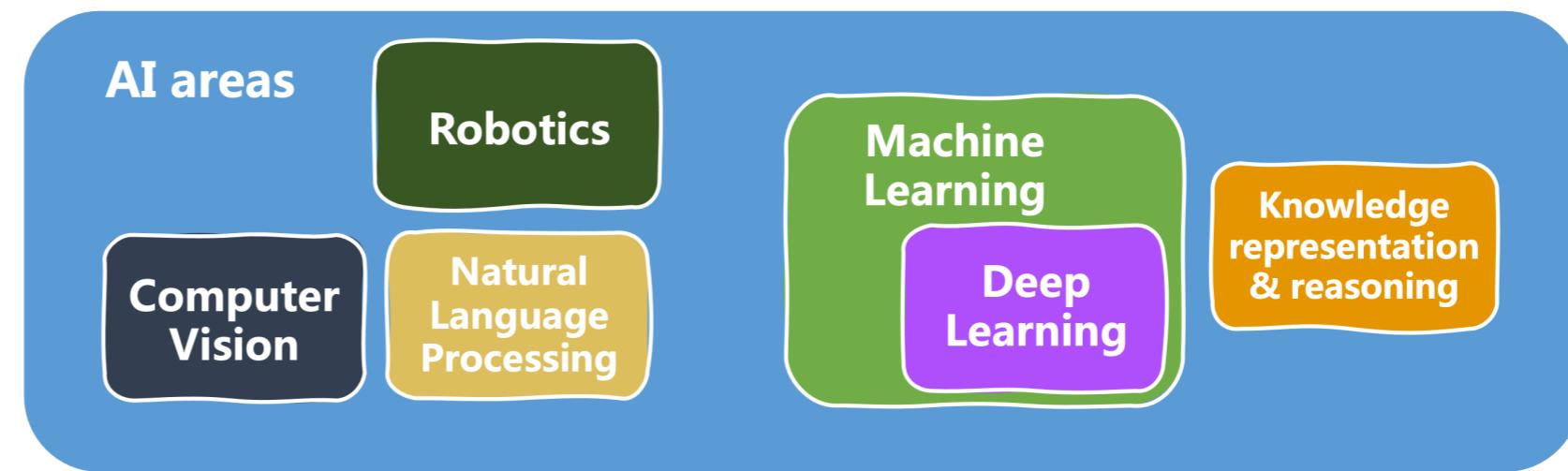
Maarten Van den Broeck

Senior Content Developer at DataCamp

AI functions and areas involved



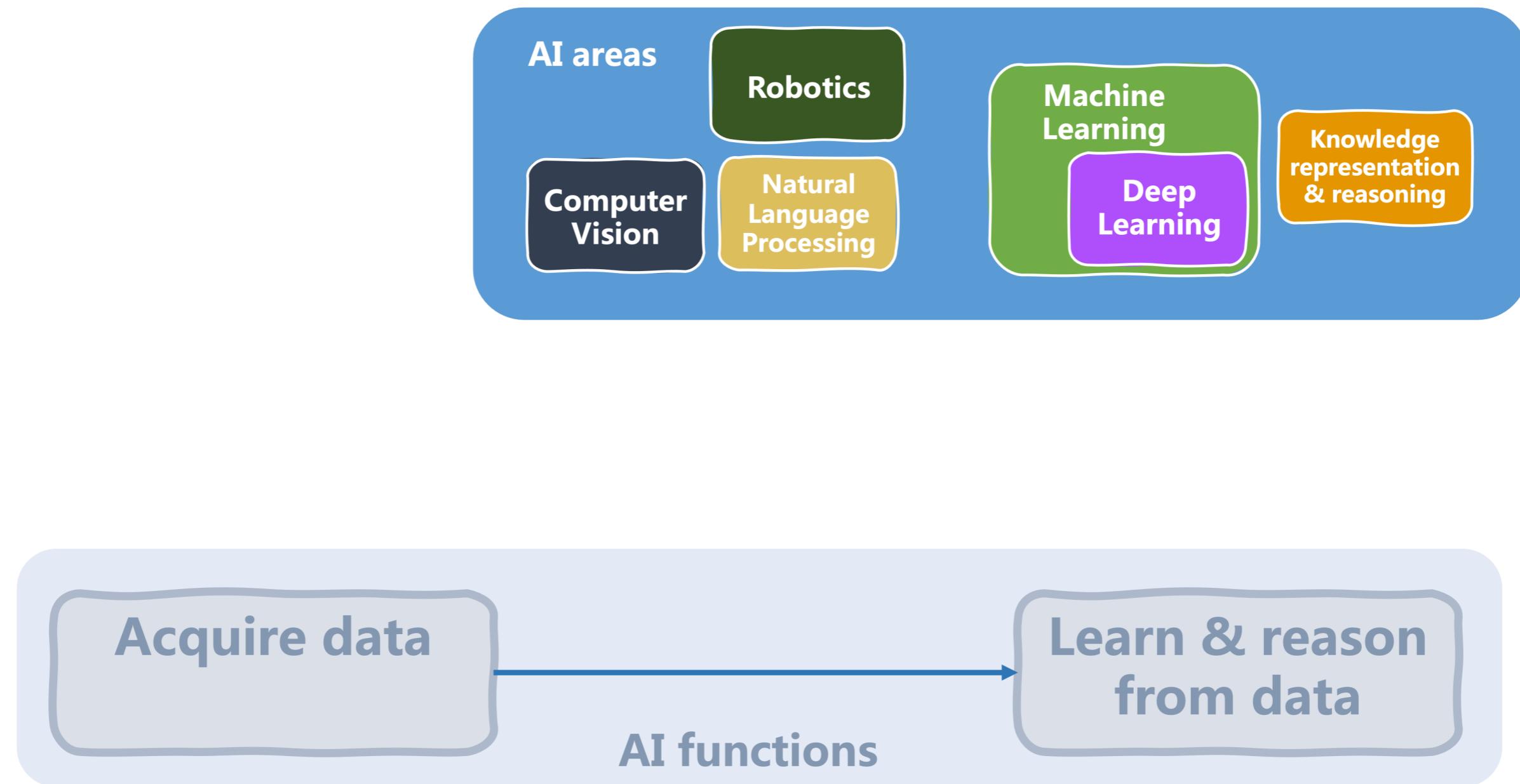
AI functions and areas involved



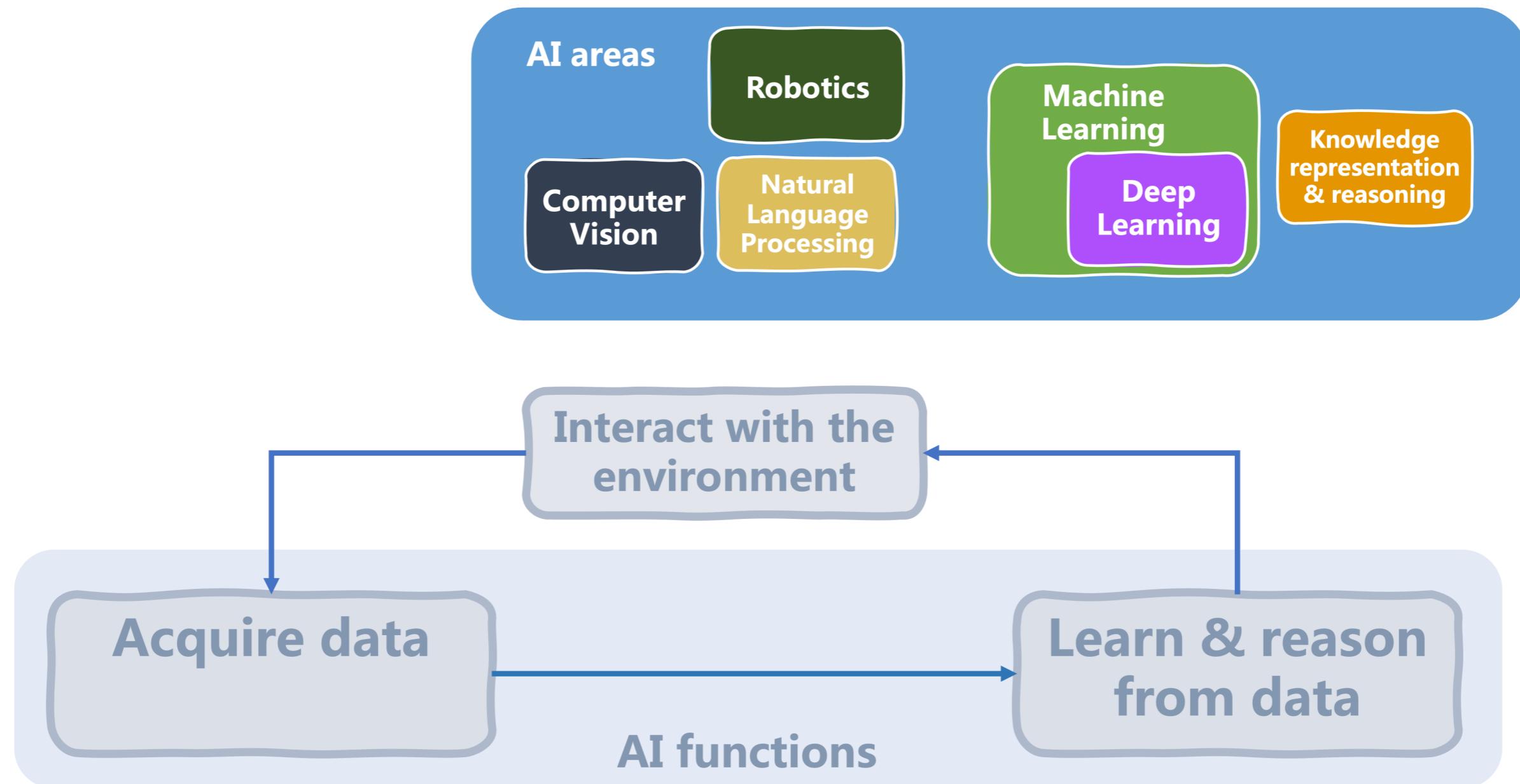
Acquire data

AI functions

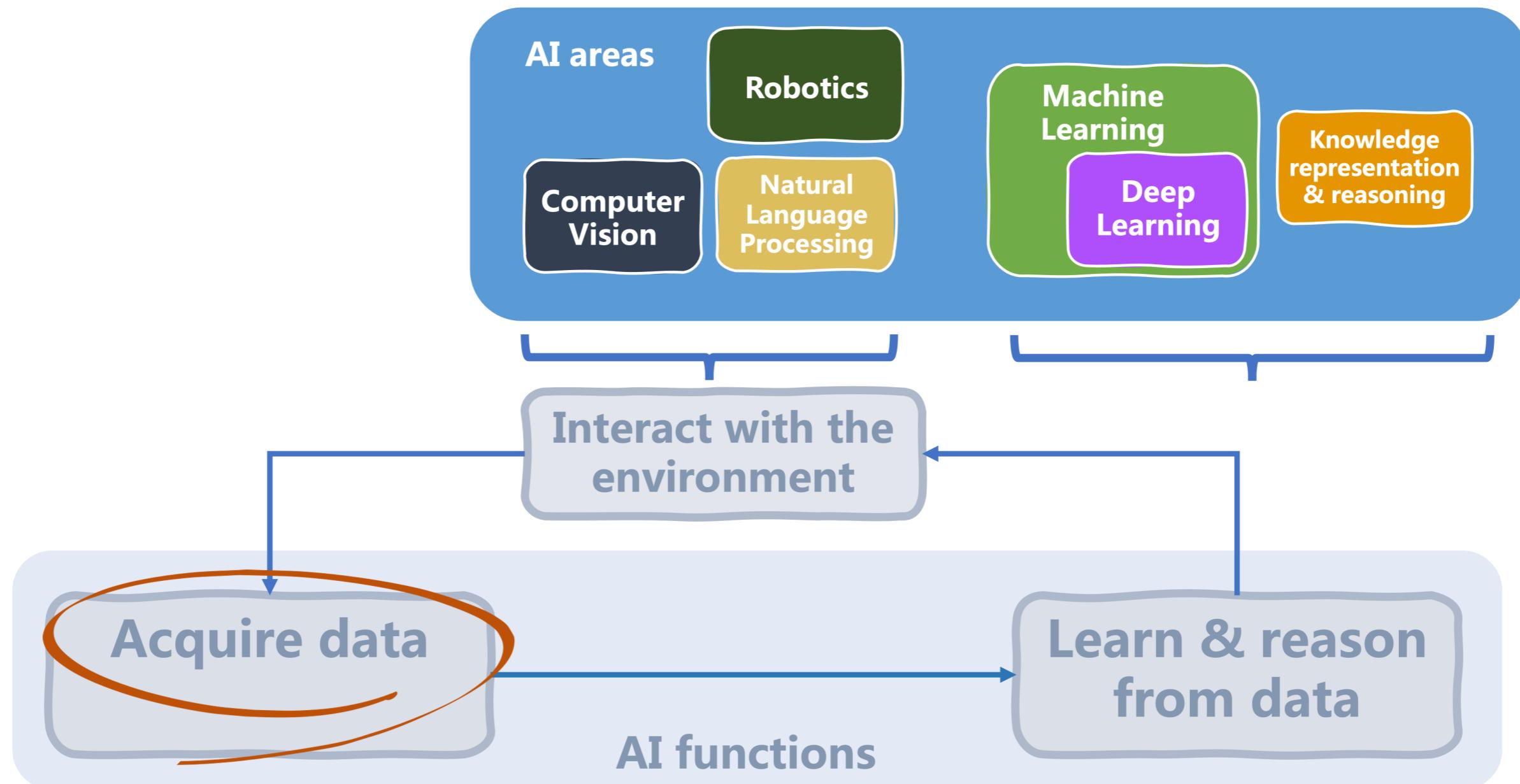
AI functions and areas involved



AI functions and areas involved



AI functions and areas involved



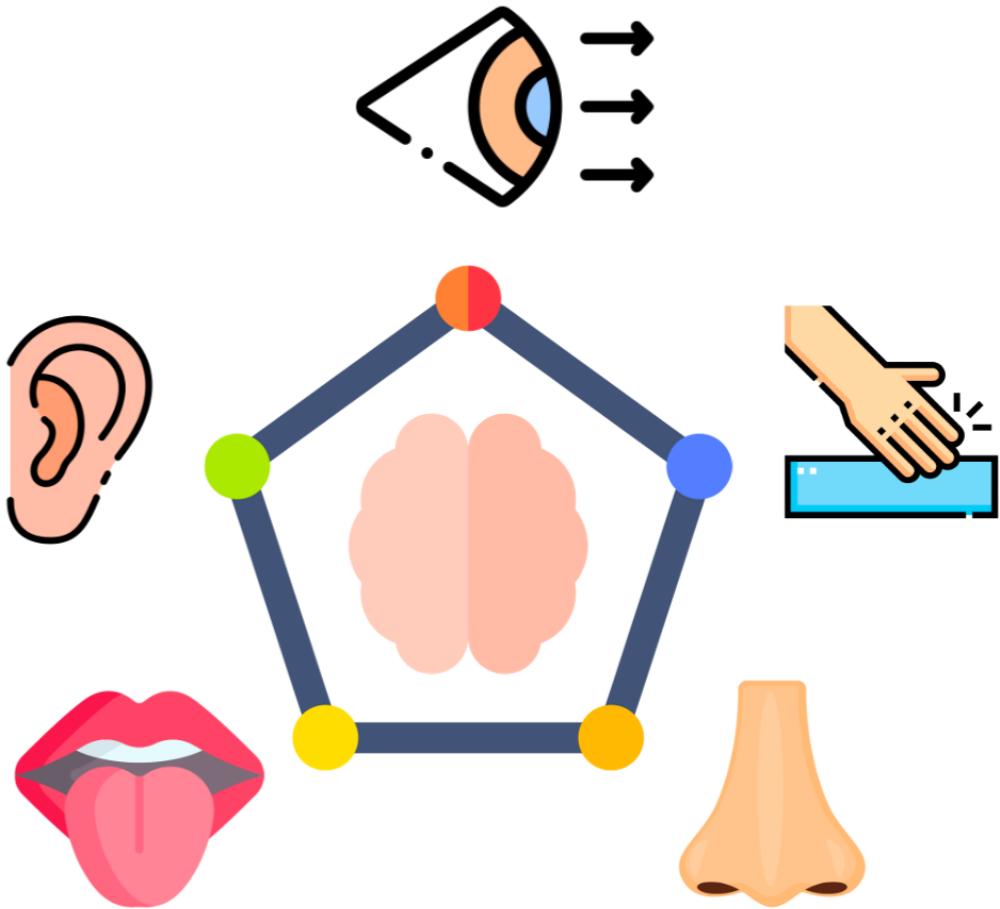
Data acquisition: sensing the environment

Collect outside sensory information through **sensors**: mimic human senses

Transform perceptions into **data**

Occurs in:

- **NLP and audio**: capturing speech, sounds
- **Computer Vision**: satellite images, fingerprint, etc.
- **Robotics and sensors**: temperature, touch, motion, gravity, etc.



Data acquisition: datasets

Dataset collection of data: data samples or instances of a given type of data

- **Structured:** tabular format, spreadsheets
- **Unstructured:** images, audio, videos, text, ...

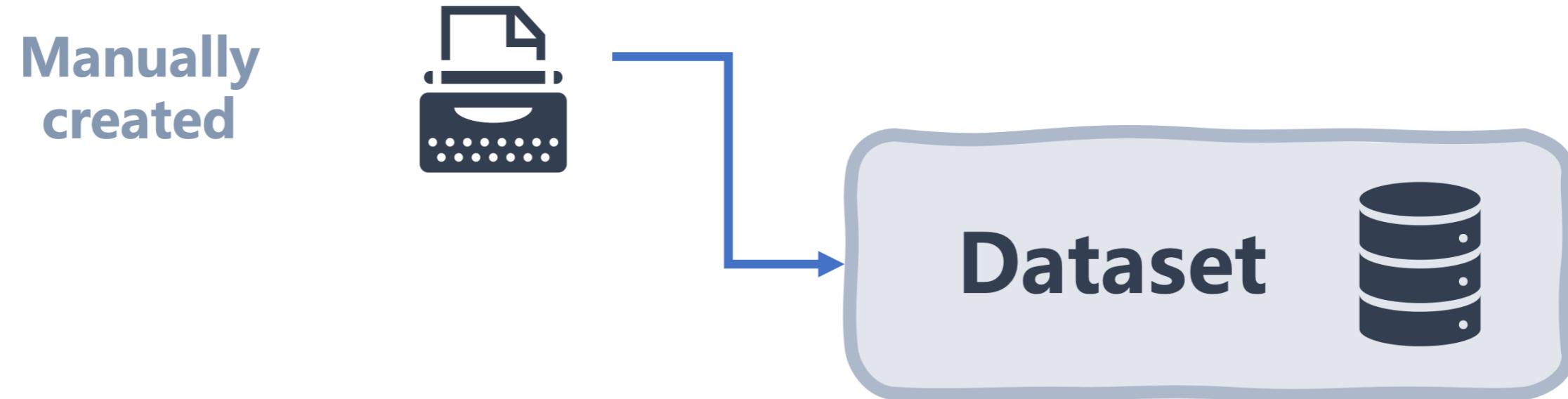
Dataset



Data acquisition: datasets

Dataset collection of data: data samples or instances of a given type of data

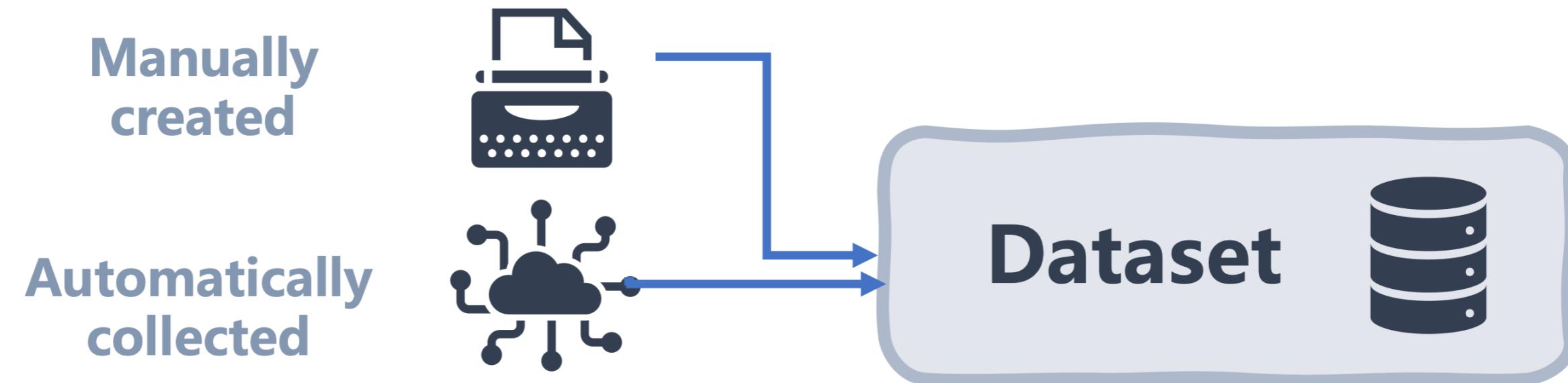
- **Structured:** tabular format, spreadsheets
- **Unstructured:** images, audio, videos, text, ...



Data acquisition: datasets

Dataset collection of data: data samples or instances of a given type of data

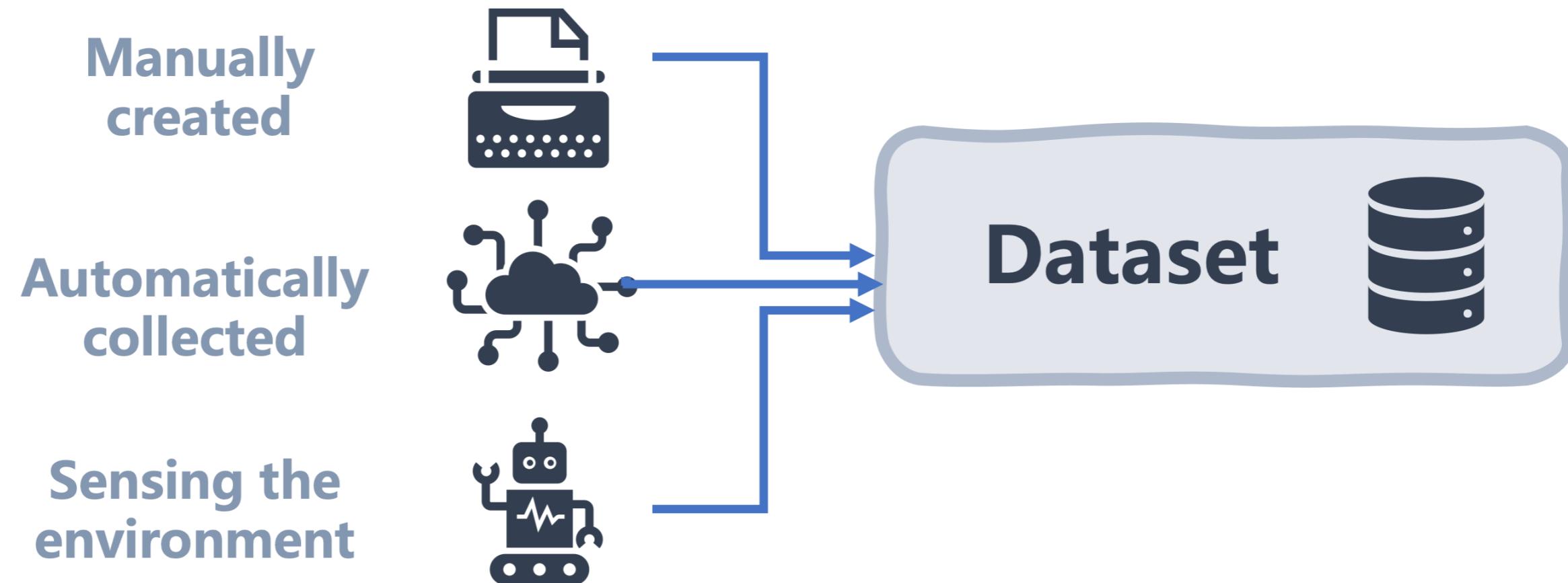
- **Structured:** tabular format, spreadsheets
- **Unstructured:** images, audio, videos, text, ...



Data acquisition: datasets

Dataset collection of data: data samples or instances of a given type of data

- **Structured:** tabular format, spreadsheets
- **Unstructured:** images, audio, videos, text, ...



Let's practice!

UNDERSTANDING ARTIFICIAL INTELLIGENCE

Learning from data

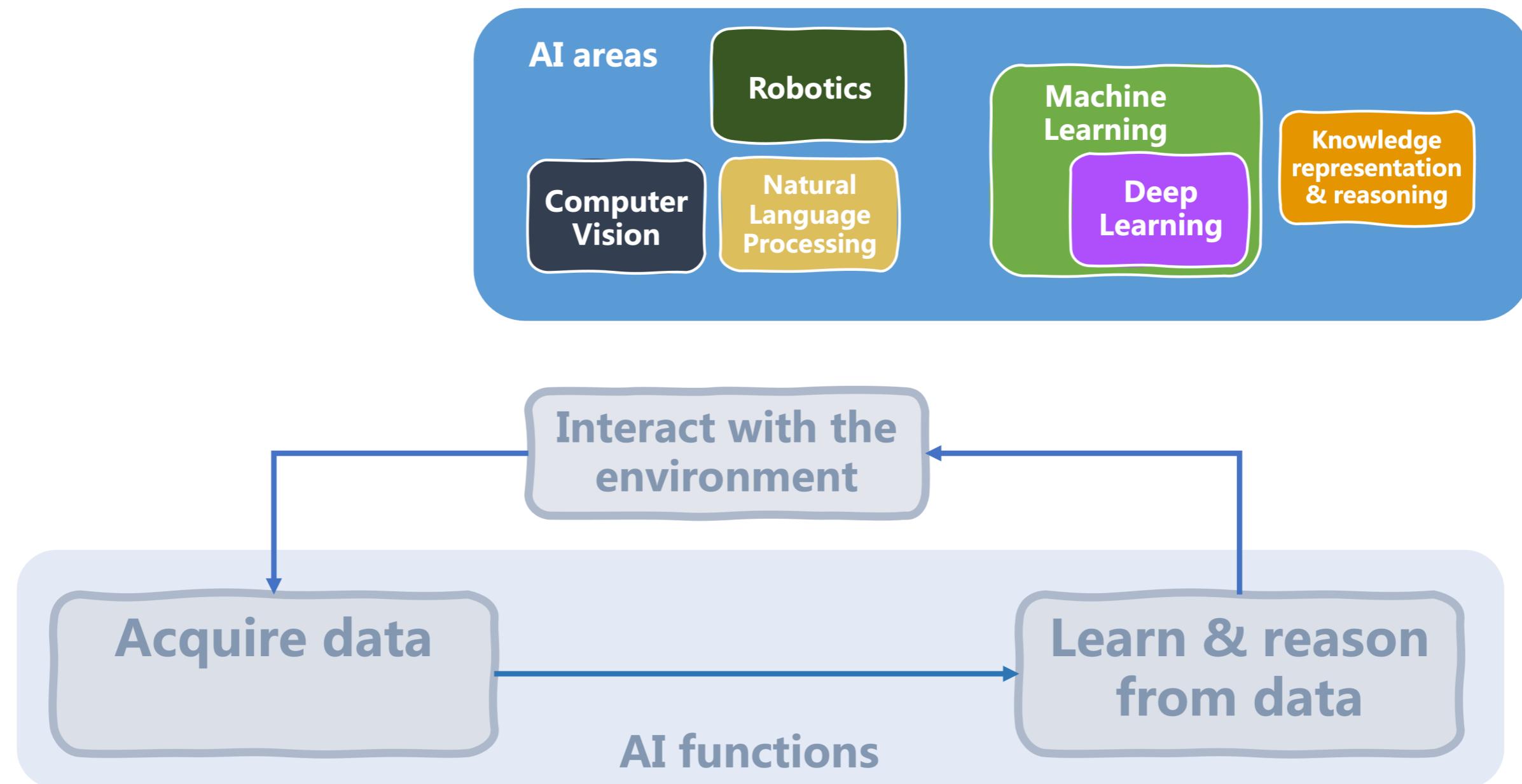
UNDERSTANDING ARTIFICIAL INTELLIGENCE



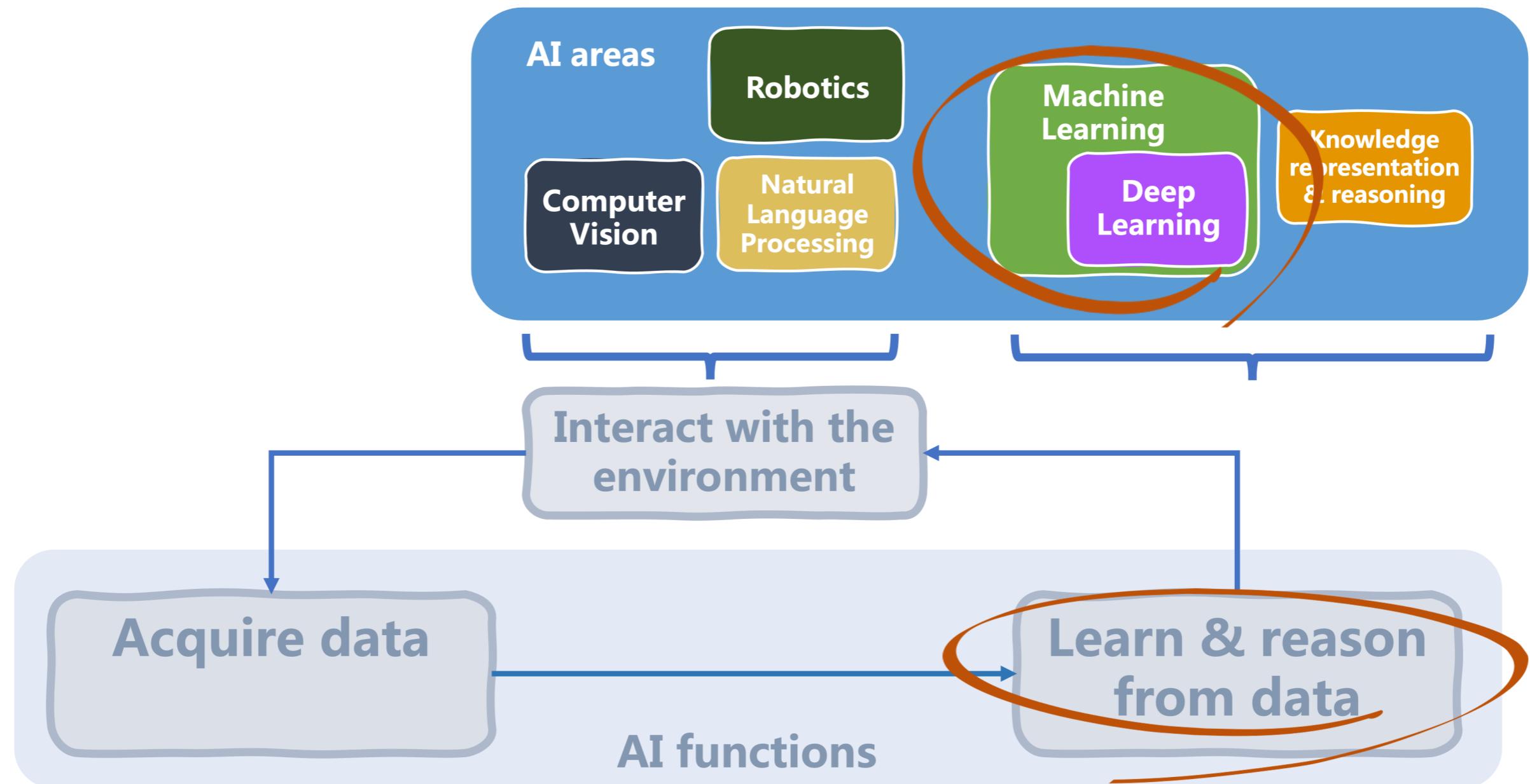
Maarten Van den Broeck

Senior Content Developer at DataCamp

AI functions and areas involved

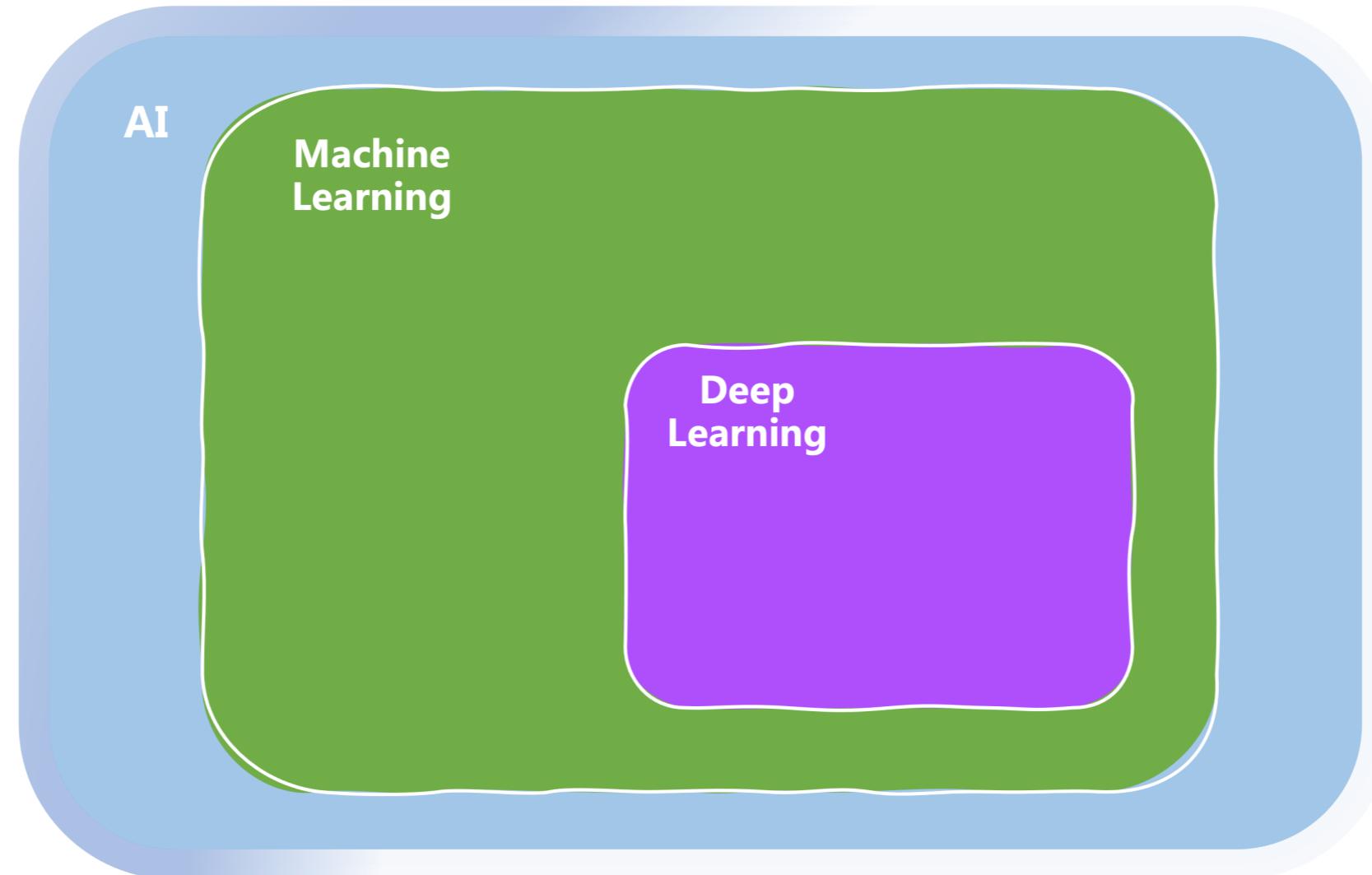


AI functions and areas involved



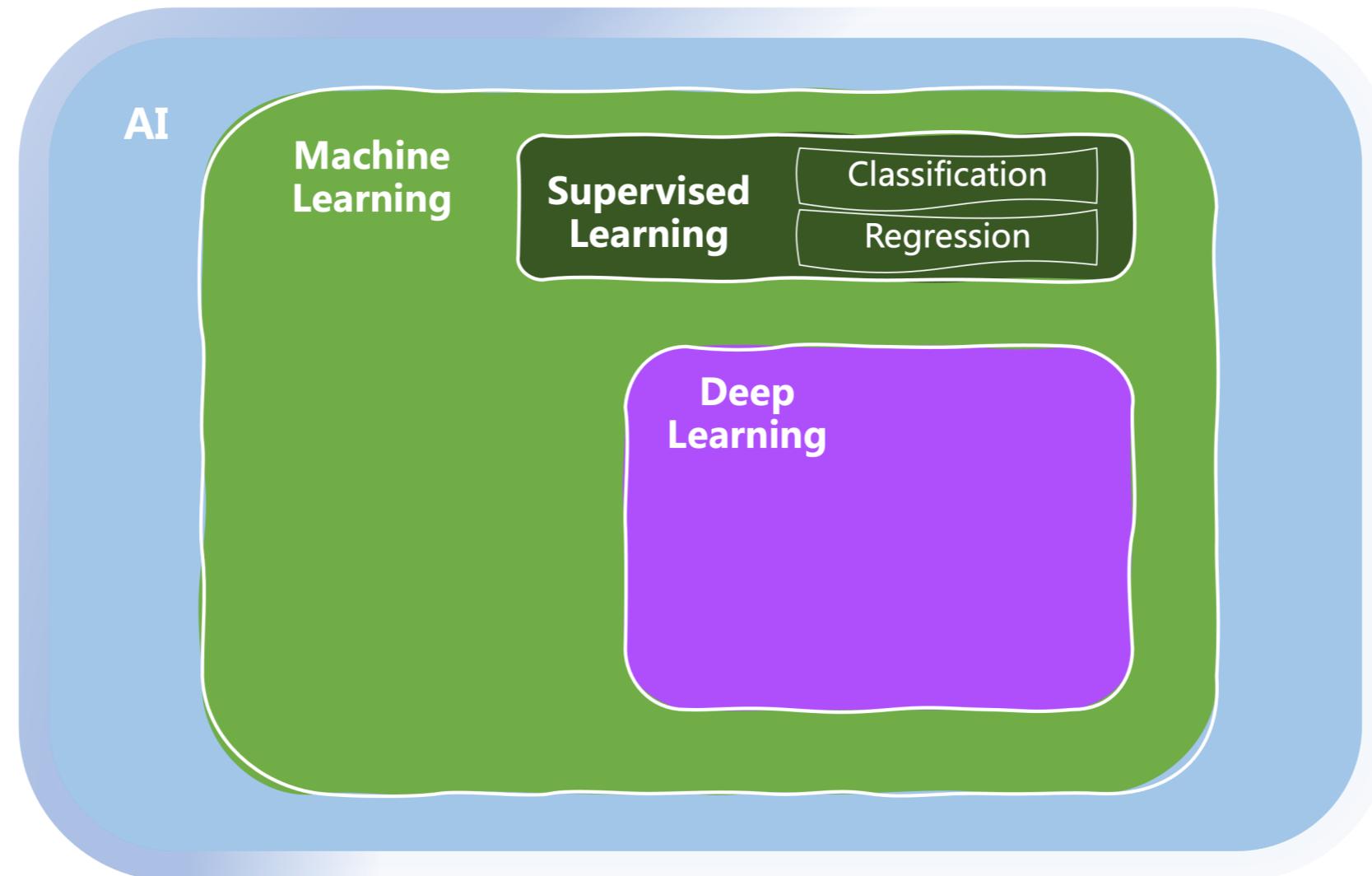
Enter Machine Learning (ML)

Machine Learning: learn from data and identify patterns



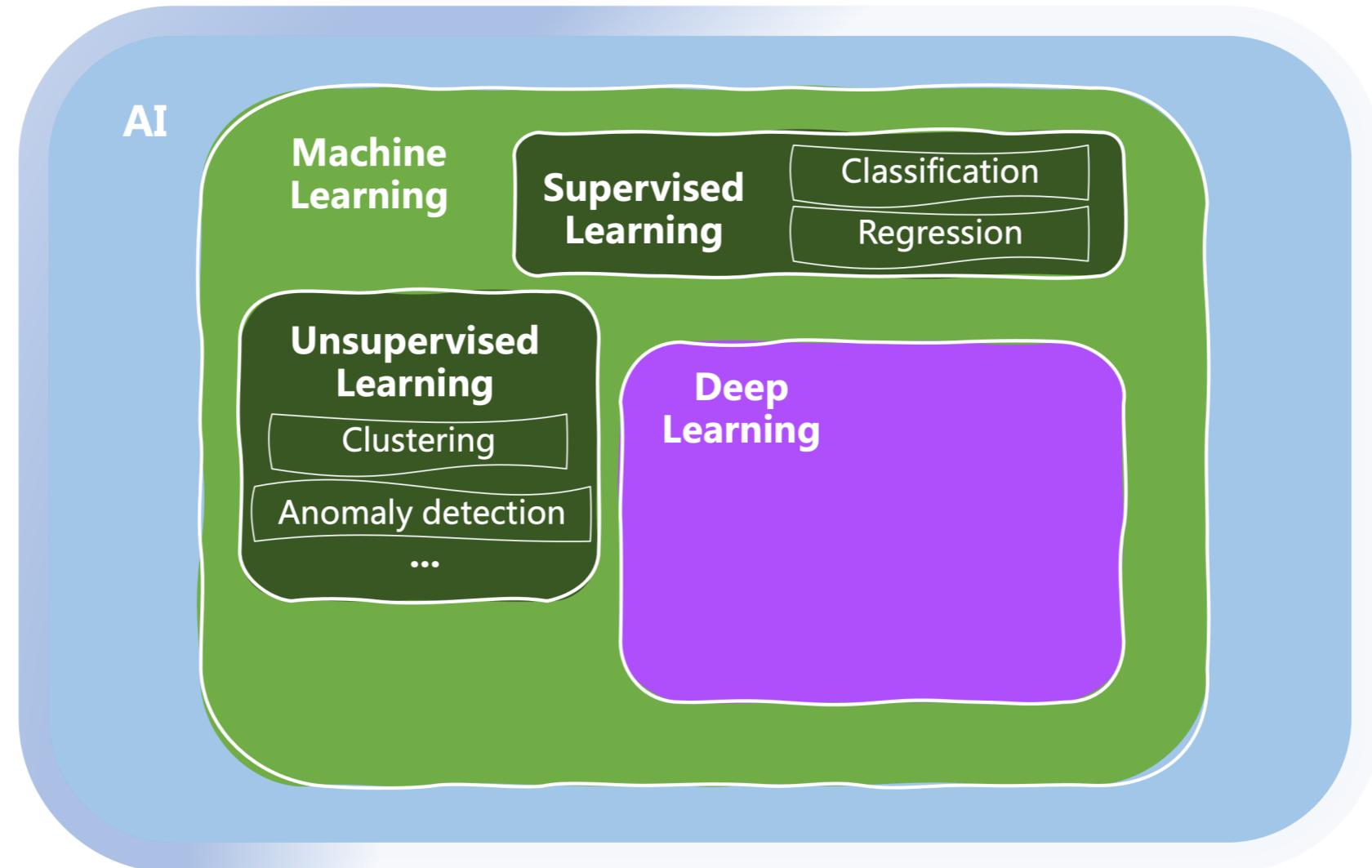
Enter Machine Learning (ML)

Machine Learning: learn from data and identify patterns



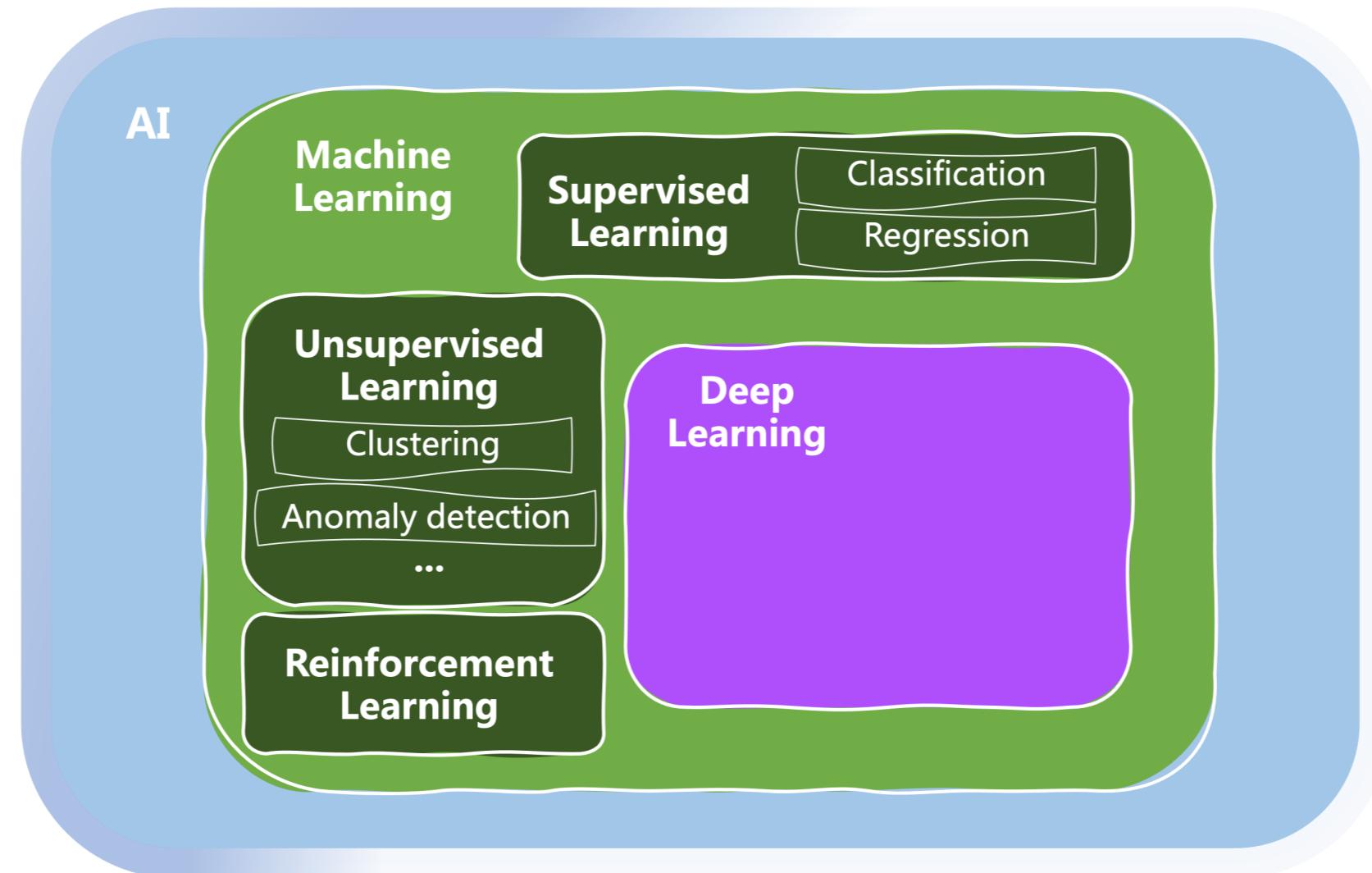
Enter Machine Learning (ML)

Machine Learning: learn from data and identify patterns



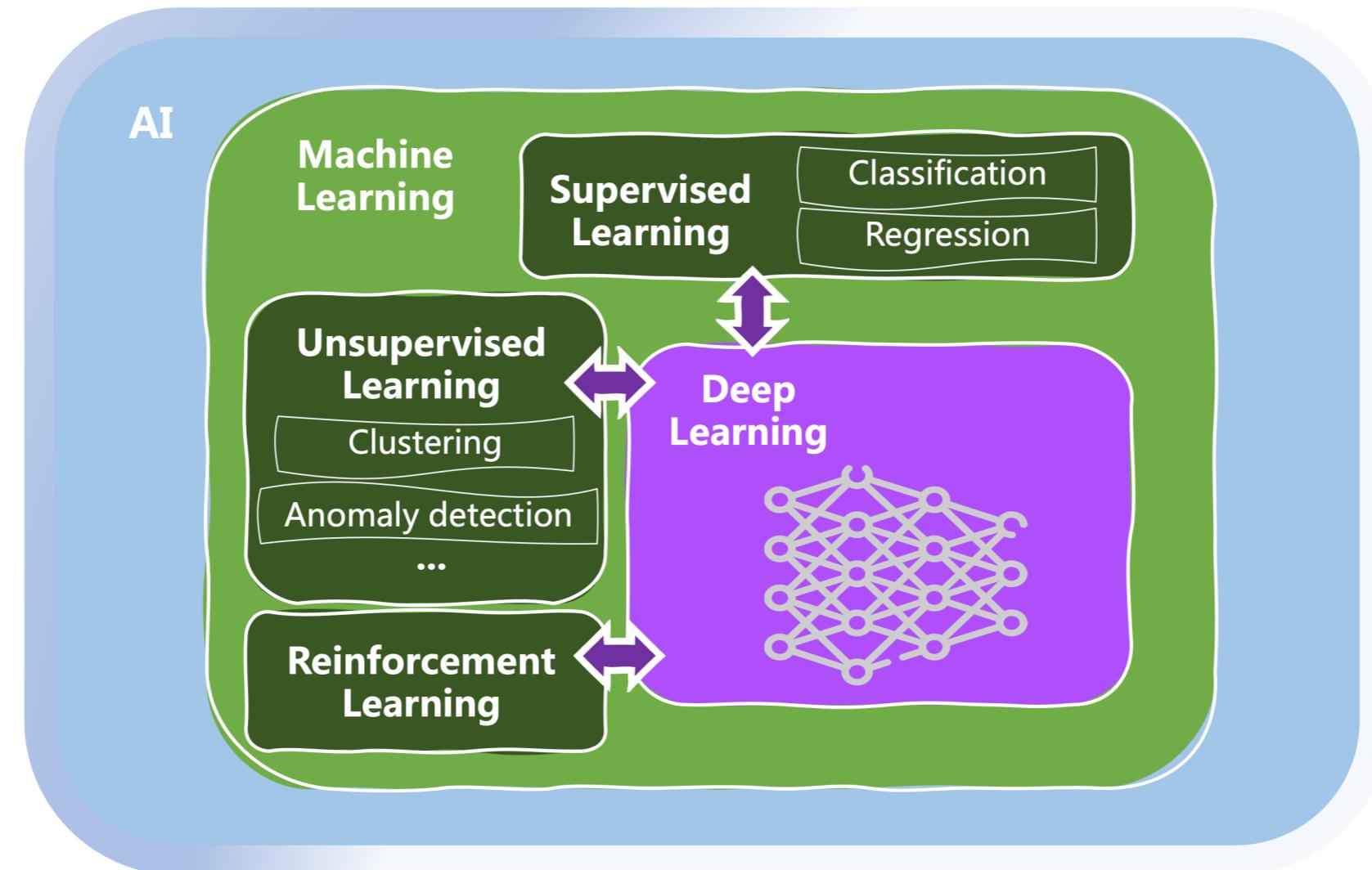
Enter Machine Learning (ML)

Machine Learning: learn from data and identify patterns



Enter Machine Learning (ML)

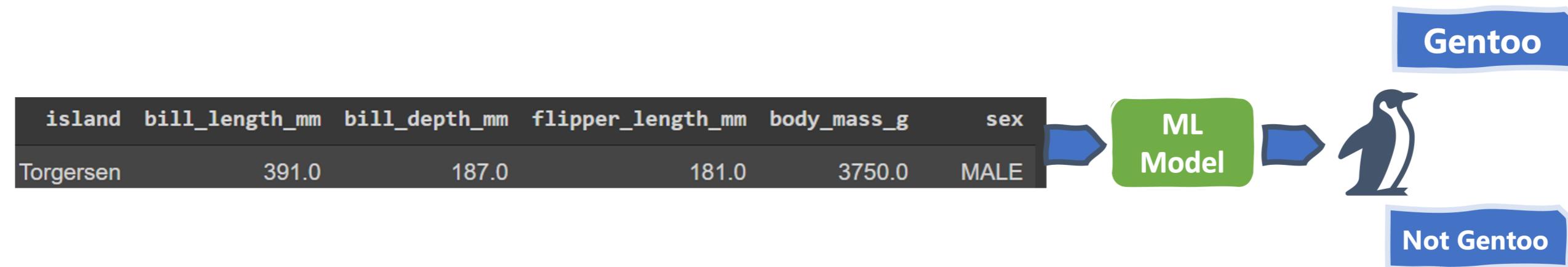
Machine Learning: learn from data and identify patterns



Supervised Learning: classification

Classification: assign each data observation the category (*class*) it may belong to

- **Binary classification:** two classes, e.g. positive/negative, male/female, etc.

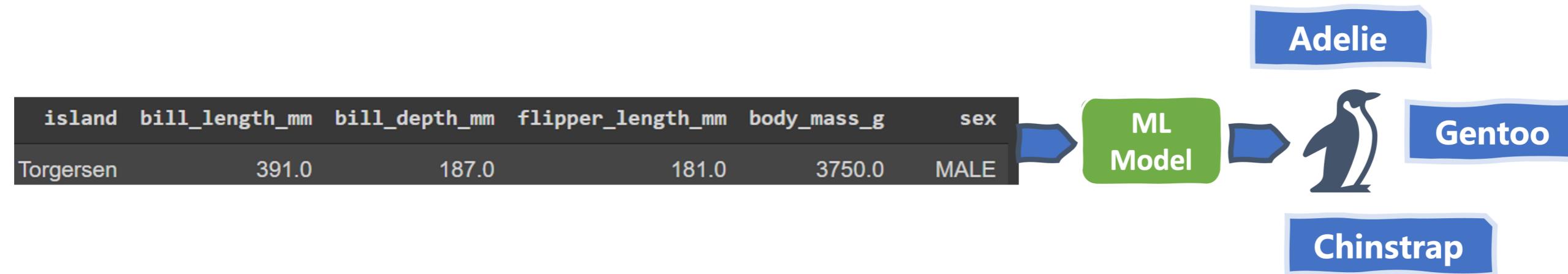


Supervised Learning: classification

Classification: assign each data observation the category (*class*) it may belong to

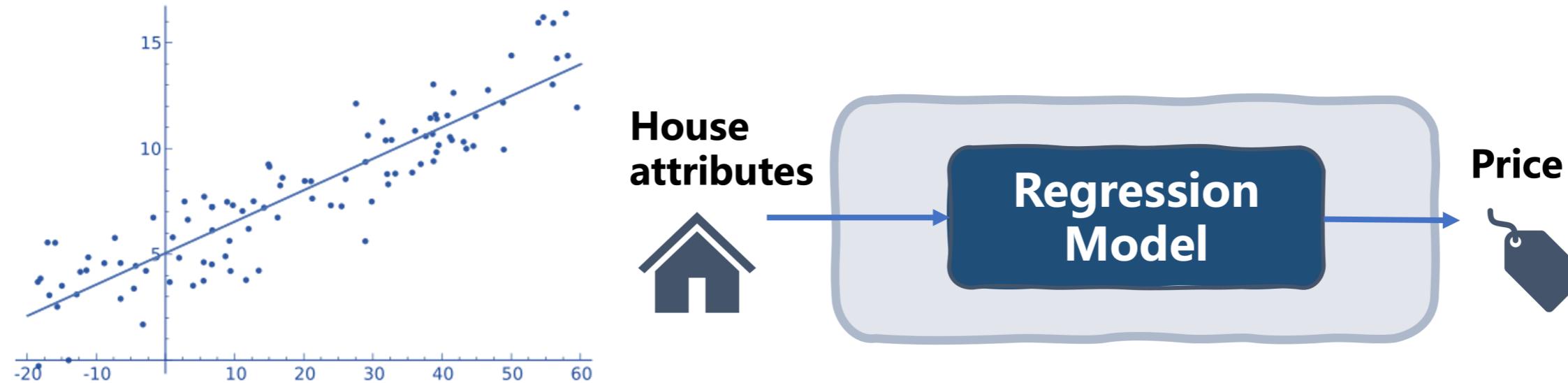
- **Binary classification:** two classes, e.g. positive/negative, male/female, etc.
- **Multi-class classification:** several mutually exclusive classes, e.g. multiple species

Supervised learning: *Data annotation* (getting labelled observations with *known class a priori*) needed to learn/train a **model** capable of making inference

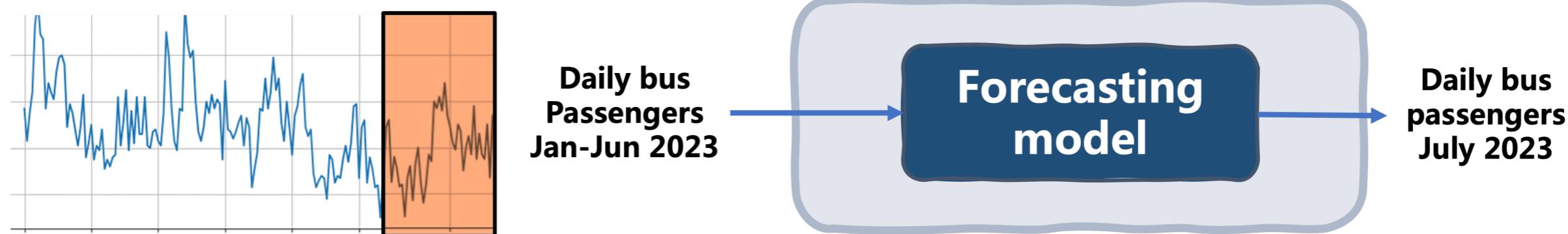


Supervised Learning: regression and forecasting

Regression: assign each data observation a numerical output or *label* based on its inputs

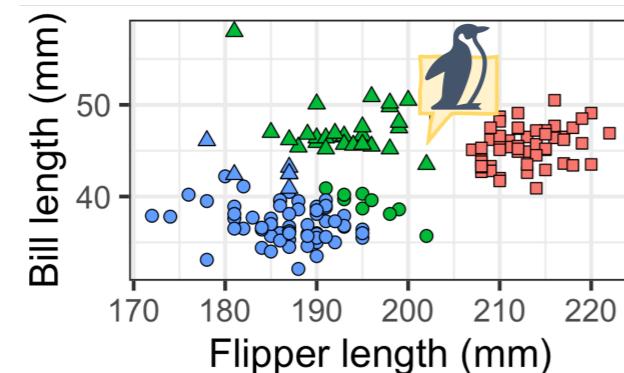


Time series forecasting: predict future values of variable, based on its past behavior



Unsupervised and reinforcement learning

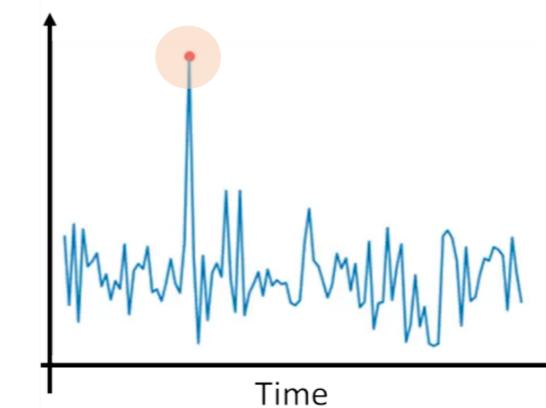
Clustering: find subgroups of data with *similar* characteristics (e.g. *k-means* algorithm)



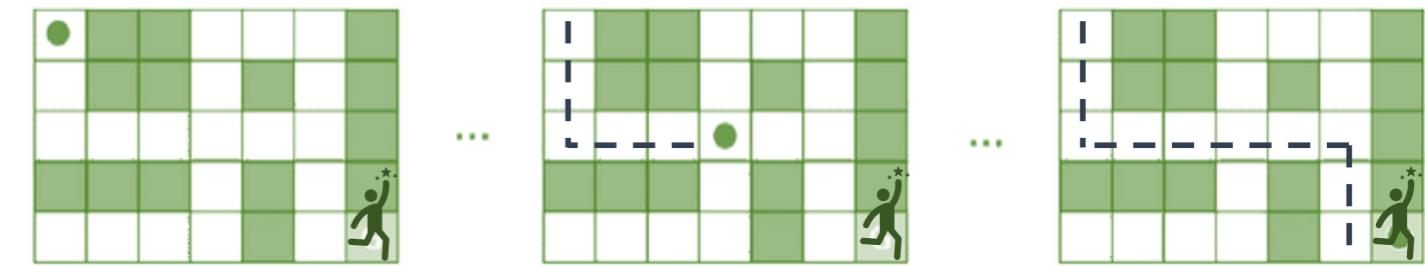
Association rule discovery: find common co-occurrences of items in transaction data



Anomaly detection: detecting *abnormal* data observations e.g. unusual card transactions

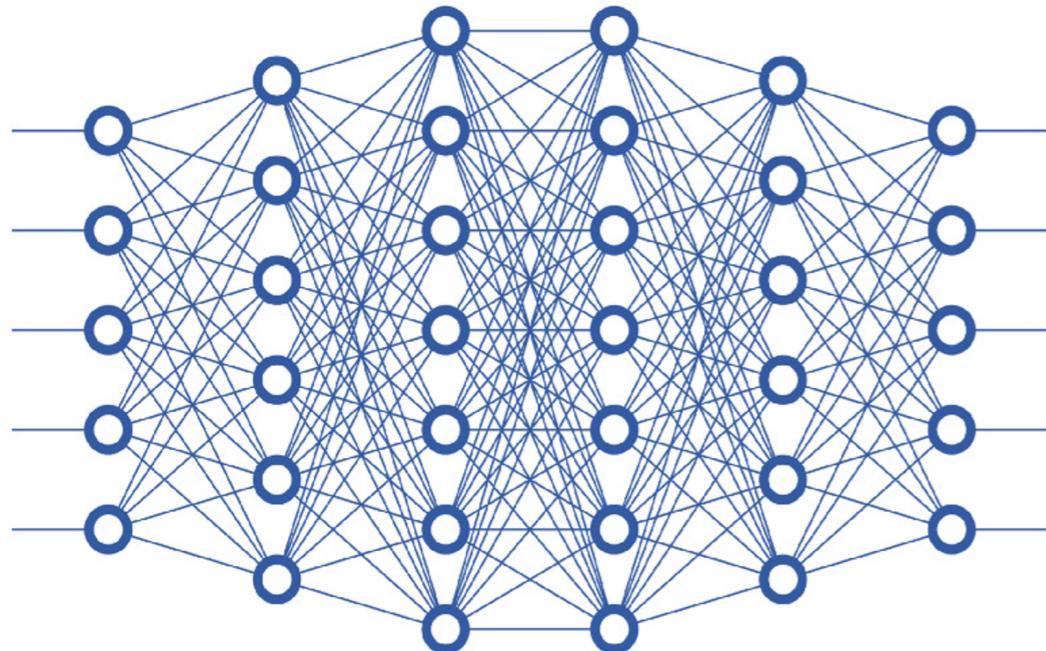


Reinforcement learning: learn by *experience* (trial and error) to master a complex task



How about Deep Learning?

- Highly sophisticated models based on **deep neural networks**: solve very challenging tasks where classical ML models become limited
 - Learn from data as a human brain would do
- Need a lot of data to learn: sometimes *millions* of observations



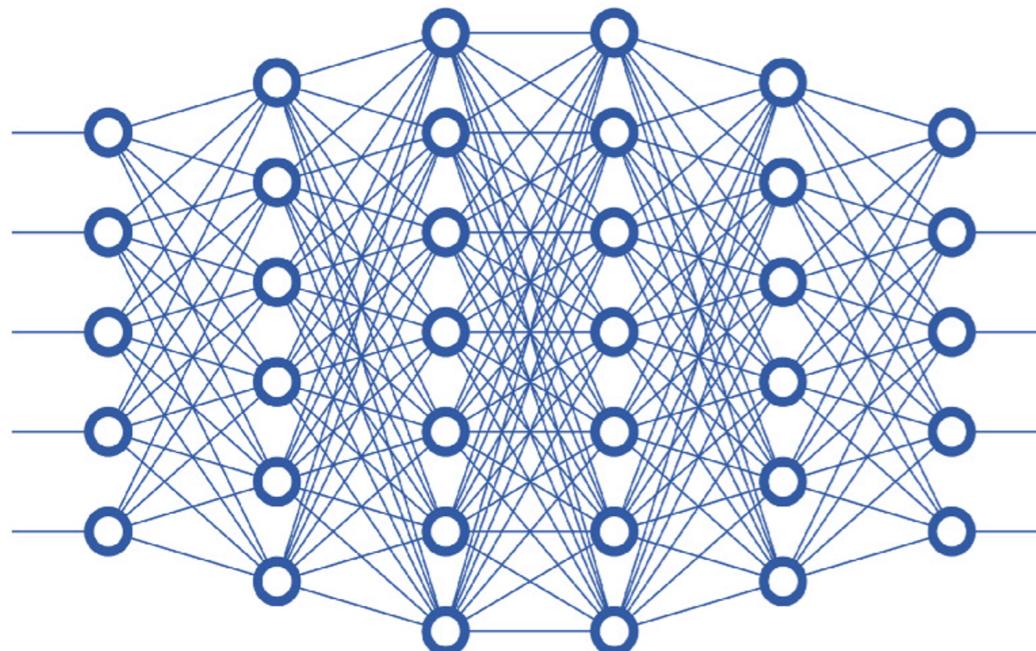
Some tasks Deep Learning can do

Classification
Regression
Forecasting
Clustering
Anomaly detection
...

How about Deep Learning?

Highly sophisticated models based on **deep neural networks**: solve very challenging tasks where classical ML models become limited

Need a lot of data to learn: sometimes *millions* of observations



Some tasks Deep Learning can do

Classification
Regression
Forecasting
Clustering
Anomaly detection
...

Recognize objects in images/video

Translation, summarization, ...

Generative AI: Large Language Models, image and music generation, ...



你好
→ Hola

men tropical shirt with blue and yellow motifs



Let's practice!

UNDERSTANDING ARTIFICIAL INTELLIGENCE

Interacting with the environment

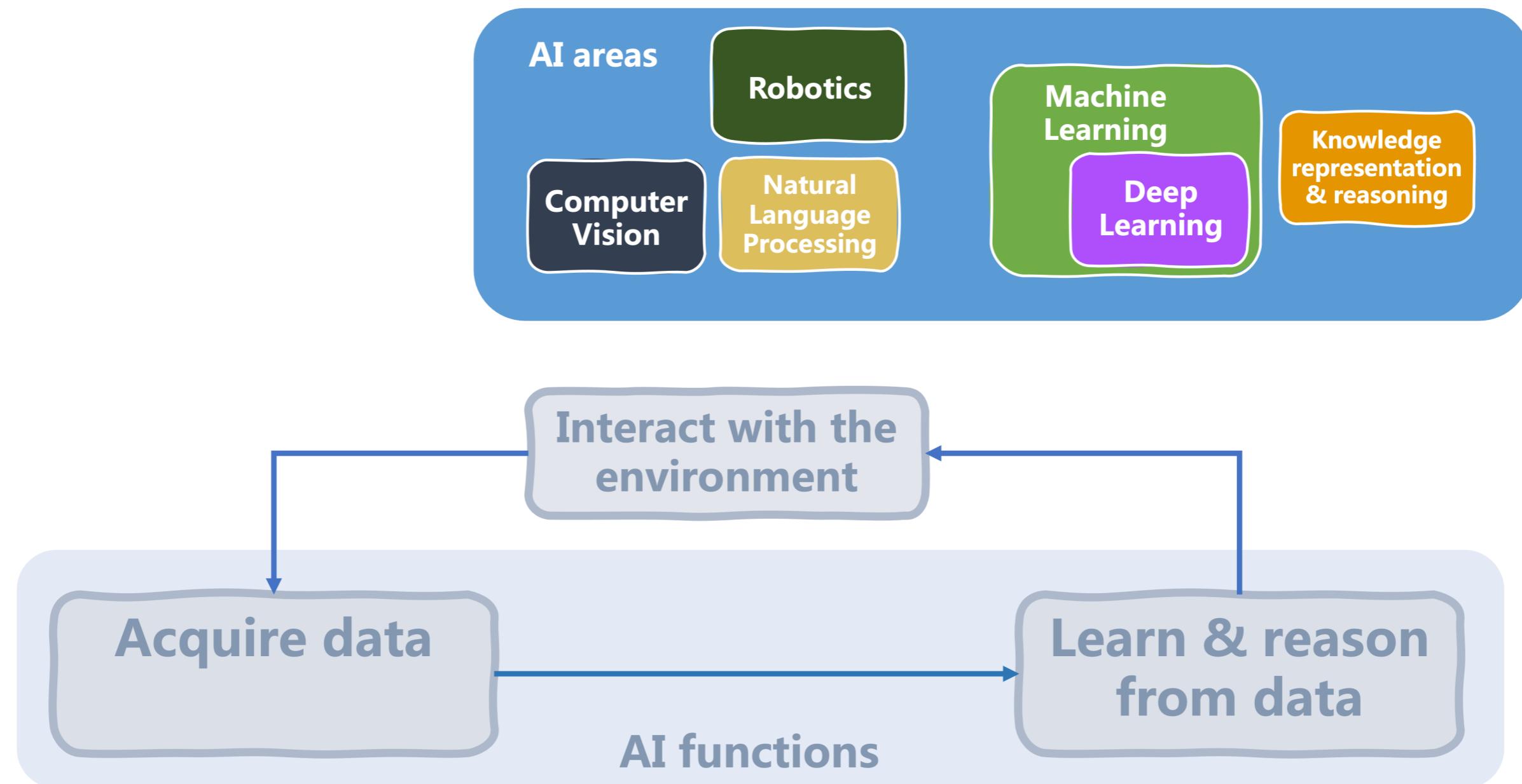
UNDERSTANDING ARTIFICIAL INTELLIGENCE



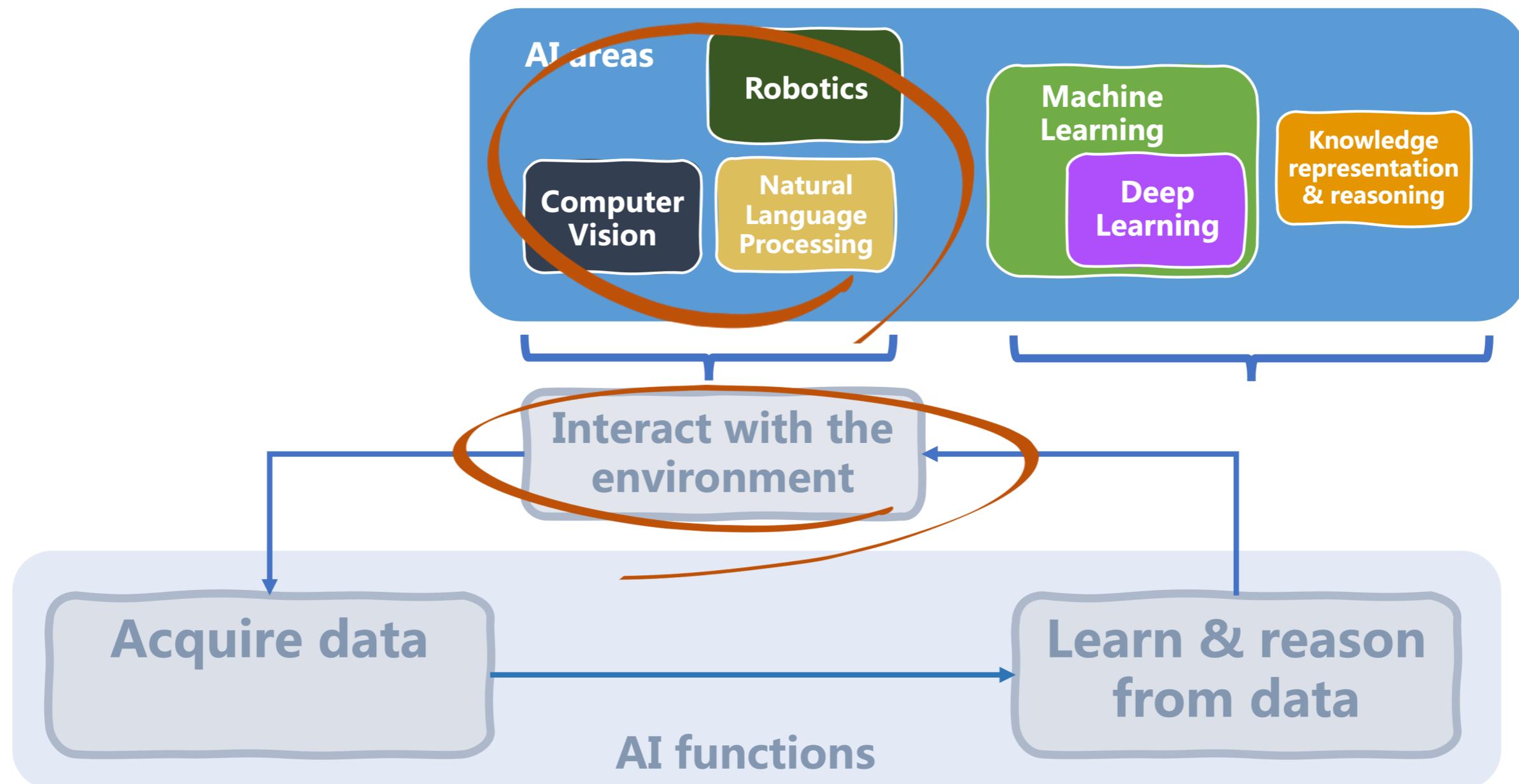
Maarten Van den Broeck

Senior Content Developer at DataCamp

AI functions and areas involved



AI functions and areas involved



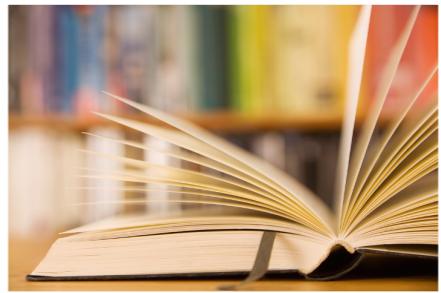
Computer vision

- **Image processing:** intelligently enhance images and video
- **Object detection:** identify subjects in images/video for surveillance, logistics, etc.
- **Motion analysis:** extract motion information like speed and direction of objects
- **Image and video generation:** create realistic visual data from human text



Natural Language Processing (NLP)

- **Text-based**
 - **Text classification**
 - **Sentiment analysis:** extract positive and negative feelings in text, e.g. customer reviews.
 - **Question answering (chatbots)**
 - **Text summarization**
- **Speech-based**
 - **Text-to-speech**
 - **Speech-to-text**

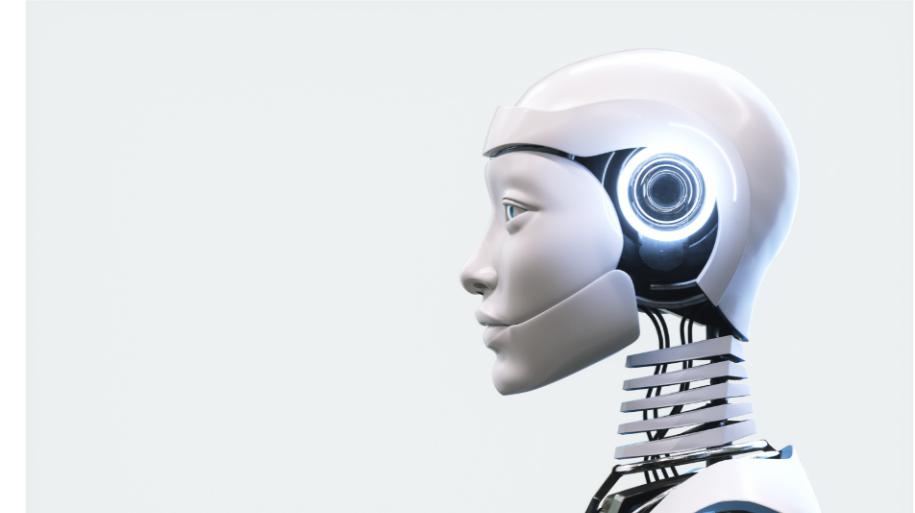


你好
↓
Hola



Robotics

- Combine computer vision and NLP
- **Sensing and perception:** collecting data or perceiving signals
- **Mobility:** moving in the environment guided by perceptions of surroundings
- **Manipulation:** the robot modifies its environment
- **Human-robot interaction:** e.g. conversational robots endowed with NLP



Let's practice!

UNDERSTANDING ARTIFICIAL INTELLIGENCE