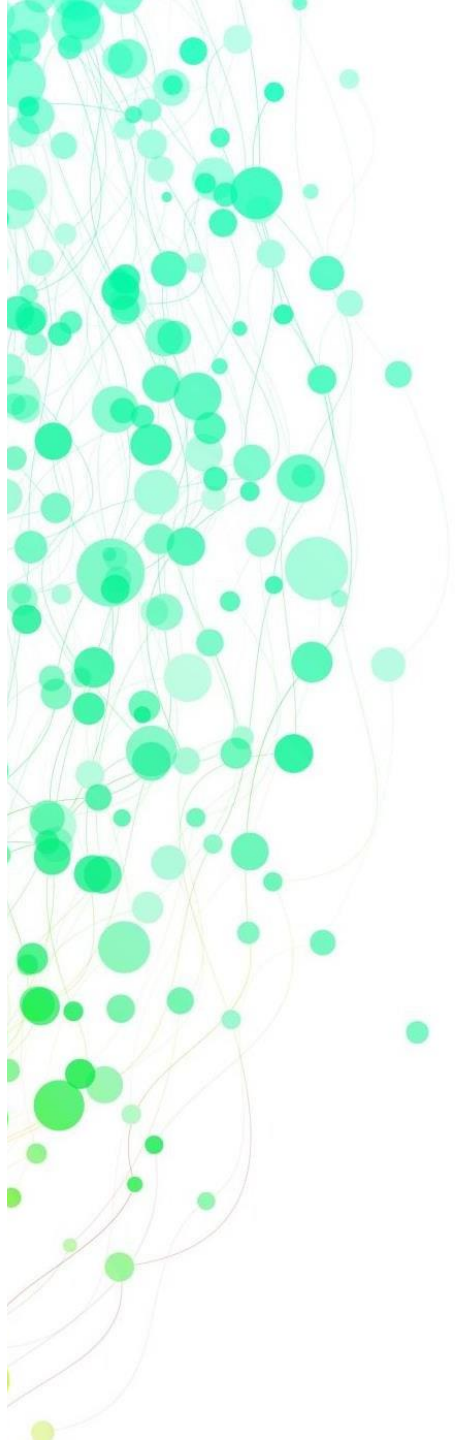
Deep Learning

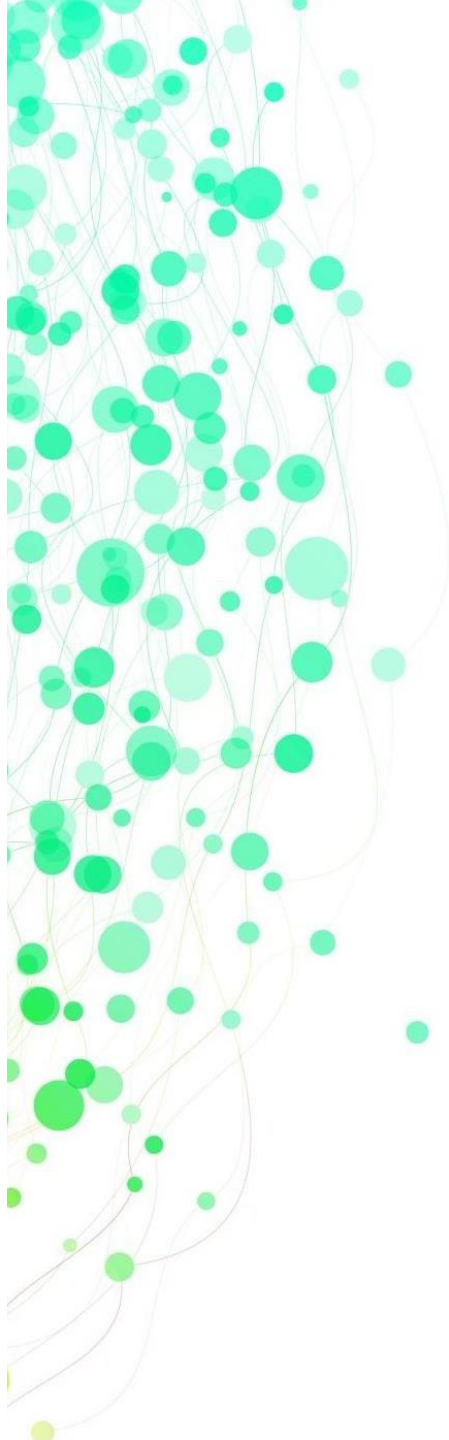
21CSA640

Dr. Vimina E R



Why study Deep Learning?

- Mollywood Godfather Extended: Deepfake Edition | Mohanlal, Mammootty, DQ and Fahadh Faasil – YouTube
- https://www.facebook.com/reel/3676485885902222
- https://twitter.com/i/status/1851258134049837169
- https://www.youtube.com/watch?v=IQWUKWM2JrQ
- https://www.openaisora.video/



Some Other Interesting Applications…

- DALL·E: Creating Images from Text

TEXT PROMPT an illustration of a baby daikon radish in a tutu walking a dog

AI-GENERATED IMAGES

Edit prompt or view more images↓

TEXT PROMPT an armchair in the shape of an avocado. . . .

AI-GENERATED IMAGES

Edit prompt or view more images↓

Gemini, ChatGPT, ….

- Gemini (google.com)

Continued…

1. TEXT 2 DREAM

Text 2 Dream tool can generate amazing art and photorealistic images from just a text prompt or a combination of a text prompt + base image.

The tool is based on the Stable Diffusion deep learning, text to image model.

2. DEEP STYLE

The technique is a much more advanced version of the original Deep Dream approach. It is capable of using its own knowledge to interpret a painting style and transfer it to the uploaded image.

3. DEEP DREAM

Initially it was invented to help scientists and engineers to see what a deep neural network is seeing when it is looking in a given image. Later the algorithm has become a new form of psychedelic and abstract art.

Reference: https://deepdreamgenerator.com/

DeepFake

- Generative Adversarial Networks (GAN)
- https://www.nytimes.com/interactive/2020/11/21/science/artificial-intelligence-fake-people-faces.html
- Mollywood Godfather Extended: Deepfake Edition | Mohanlal, Mammootty, DQ and Fahadh Faasil - YouTube
- Deepfakes Web | Make Your Own Deepfake! [Online App]

Sora — OpenAI’s text-to-video model

- Sora can create videos of up to 60 seconds featuring highly detailed scenes, complex camera motion, and multiple characters with vibrant emotions.

- Sora | OpenAI

Computer Vision

Haze Removal

Colorizing videos and images

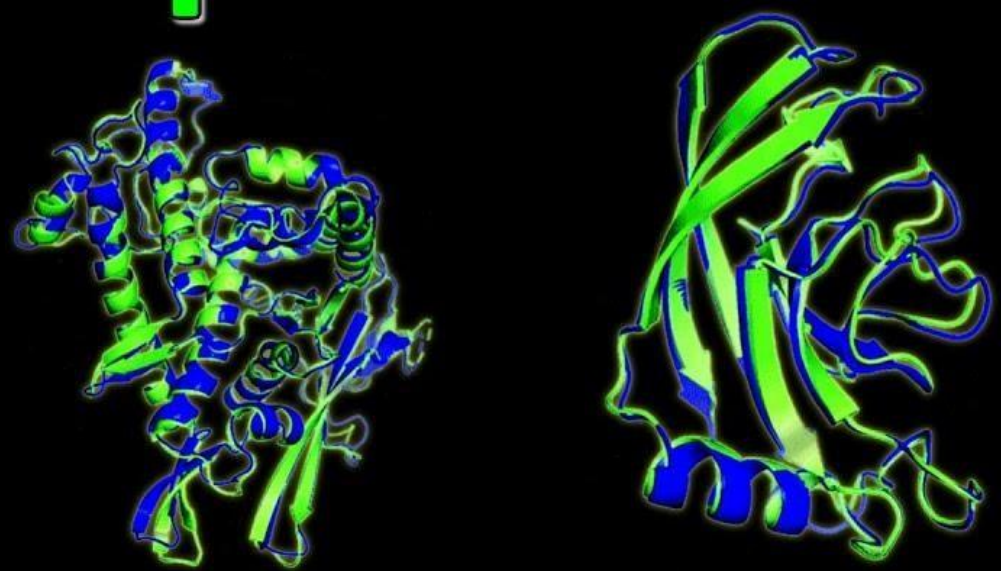
Underwater image enhancement

Night to day image conversion

Image Restoration

Google DeepMind's

AlphaFold 2



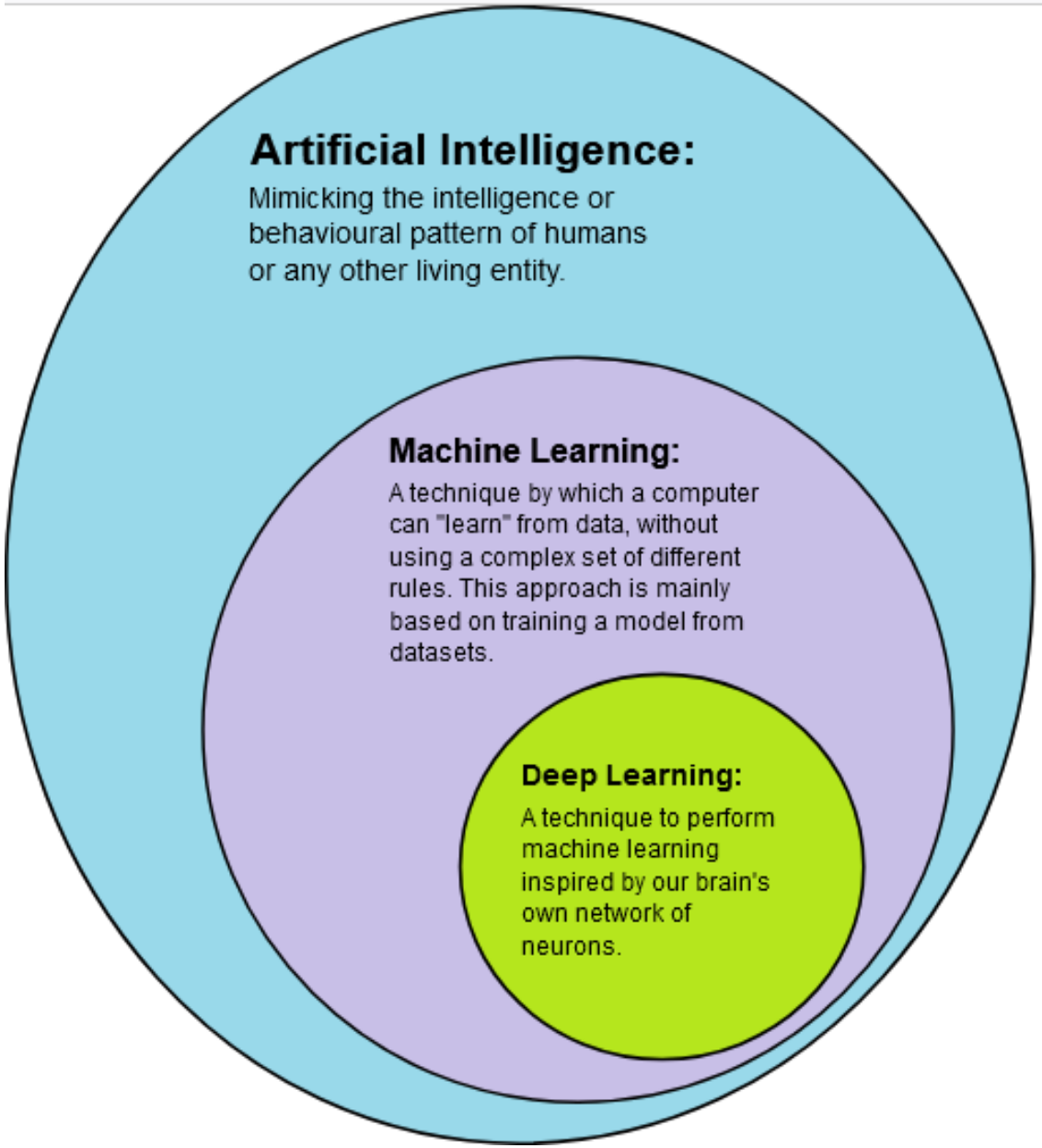
AI Breakthrough in Biology

Assessment

- Internal: External -> 50:50
- Internal Assessment
  - Mid-Term examination: 30 Marks
  - Continuous Assessment: 20Marks
    - 1. Assignment
    - 2. Test
- External Assessment
  - End semester examination: 50 marks

What is

- Artificial intelligence?
- Machine Learning?
- Deep Learning?



What is artificial intelligence?

Artificial intelligence is the ability of a computer to perform tasks commonly associated with intelligent beings.

- See and Understand
- Speak
- Decide
- Respond

What is machine learning?

Machine learning is the study of algorithms that learn from examples and experience instead of relying on hard-coded rules and make predictions on new data.

Machine Learning is the study of algorithms that

- improve their performance **P**

- at some task **T**

- with experience **E**.

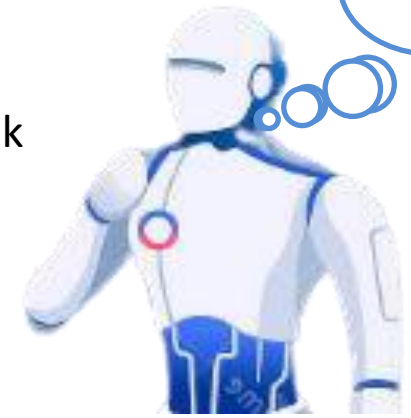
A well-defined learning task is given by **<P,T,E>**

This is a shirt we used to wear.

Color: green
Size : Large
Type : Formal

Is this a shirt ?

Ok



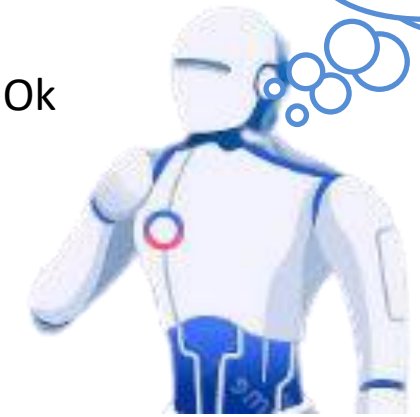
Color: Green, red
Size : Large, small
Type : Formal, casual

This is also a shirt

Is this a shirt ?

Color: Green, red, yellow
Size : Large, small, medium
Type : Formal, casual

Ok



This is also a shirt

Yes, these are all shirts

I learned to identify every shirt

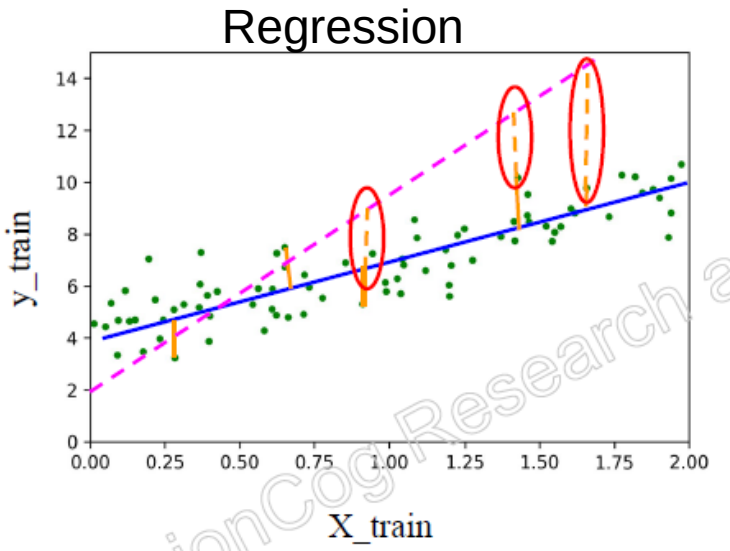
Machine Learning

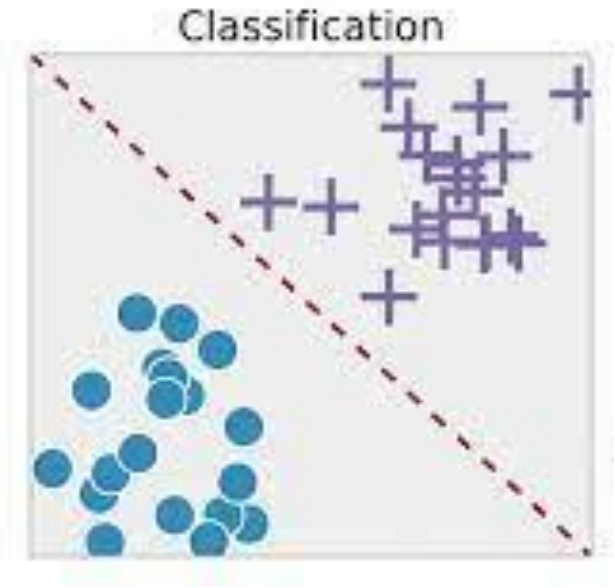
Supervised

- Learns with labelled dataset (Training set)
  - Regression
  - Classification
    - K Nearest Neighbour (KNN)
    - Support Vector Machines (SVM)
    - Decision Tree
    - Random Forest
    - Artificial Neural Networks

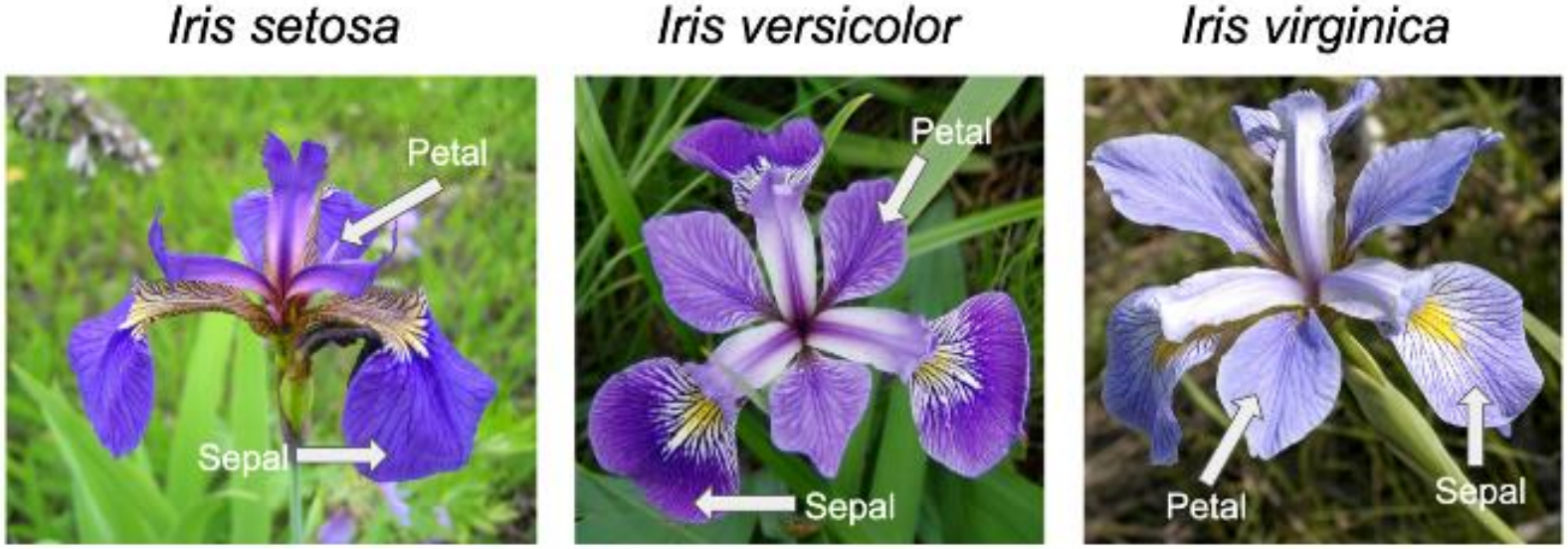
Other learnings

- Unsupervised
  - Learns from un-labelled dataset
    - Clustering
    - Association rule mining
- Reinforcement learning
- Semi Supervised





Example



Labelled Dataset **Iris Flower species**

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	versicolor
3	4.7	3.2	1.3	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
5	5.0	3.6	1.4	0.2	versicolor
6	5.4	3.9	1.7	0.4	setosa
7	4.6	3.4	1.4	0.3	Virginica
8	5.0	3.4	1.5	0.2	setosa
9	4.4	2.9	1.4	0.2	versicolor
10	4.9	3.1	1.5	0.1	versicolor

Model Training

- Data partitioning
  - Training set
  - Test set

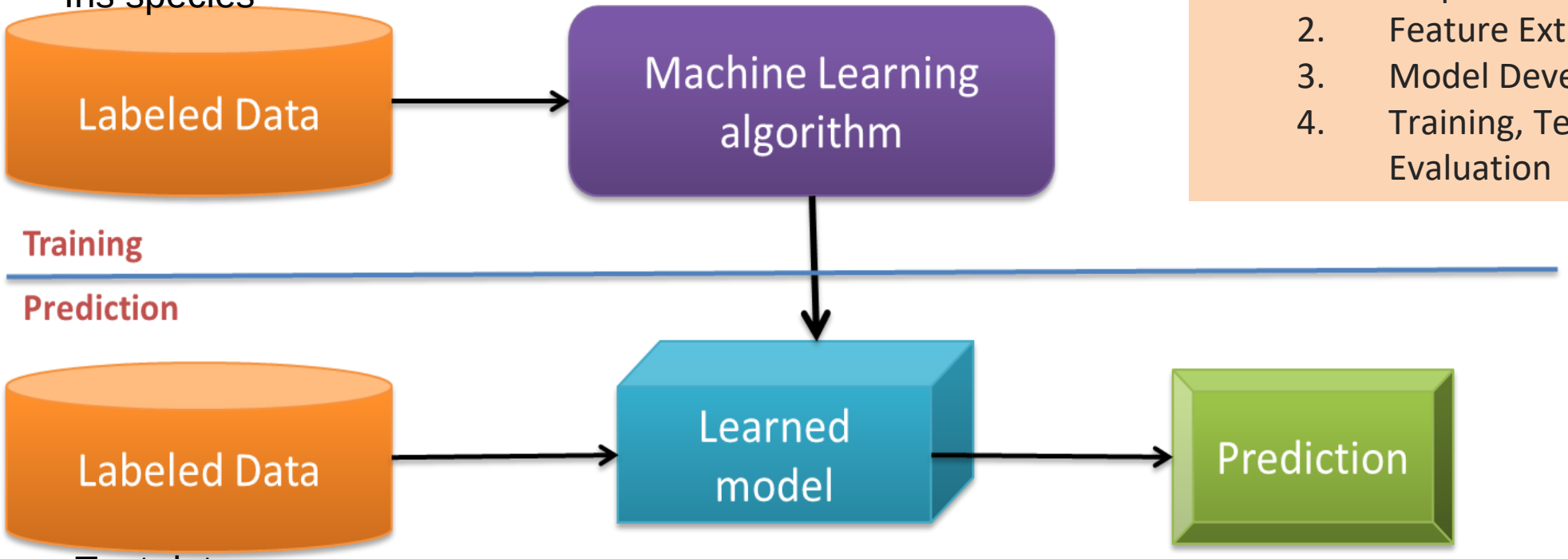
Supervised Learning Model (Classification)

Input features:
Sepal length, Sepal width, Petal length, petal width

Label:
Iris species

General methodology

1. Data Collection and Preprocessing
2. Feature Extraction
3. Model Development
4. Training, Testing and Evaluation



Test data

Species?

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width
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4.9	3.0	1.4	0.2
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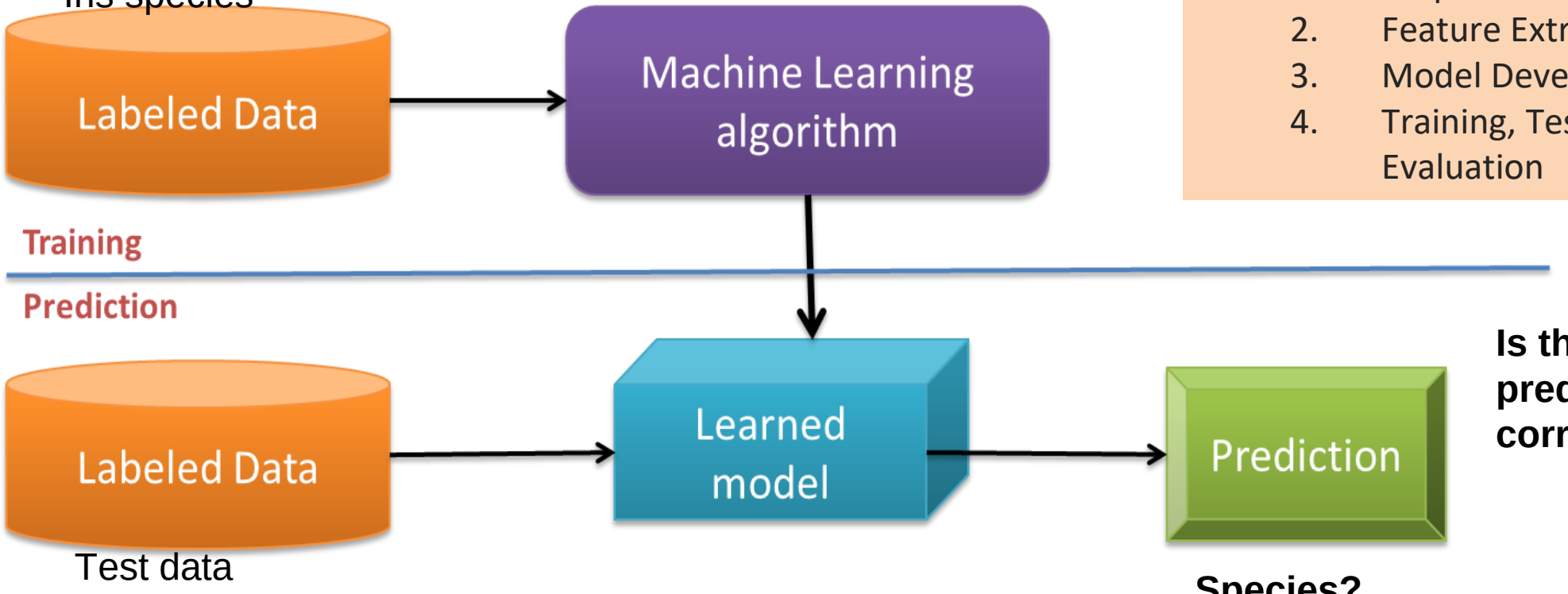

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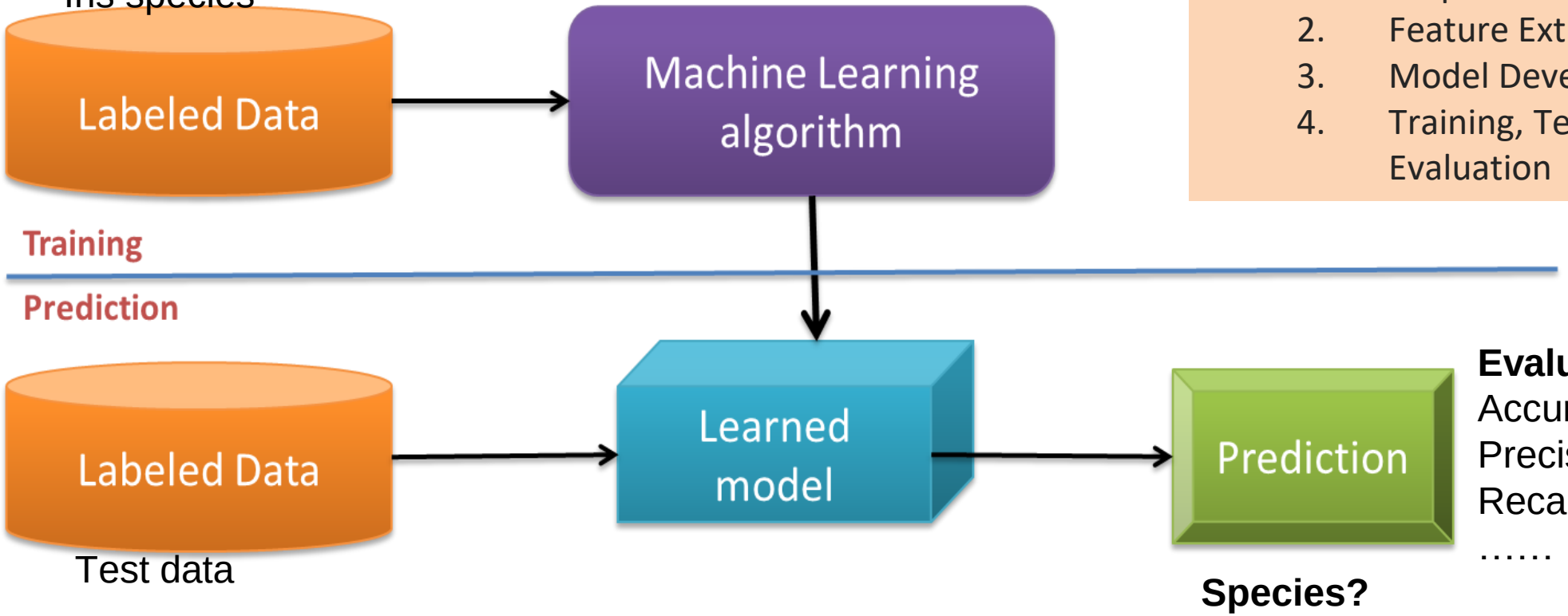

Evaluation metrics
Accuracy
Precision
Recall
……

Supervised Learning Model (Classification)

Input features:
Sepal length, Sepal width, Petal length, petal width
Label:
Iris species

General methodology
1. Data Collection and Preprocessing
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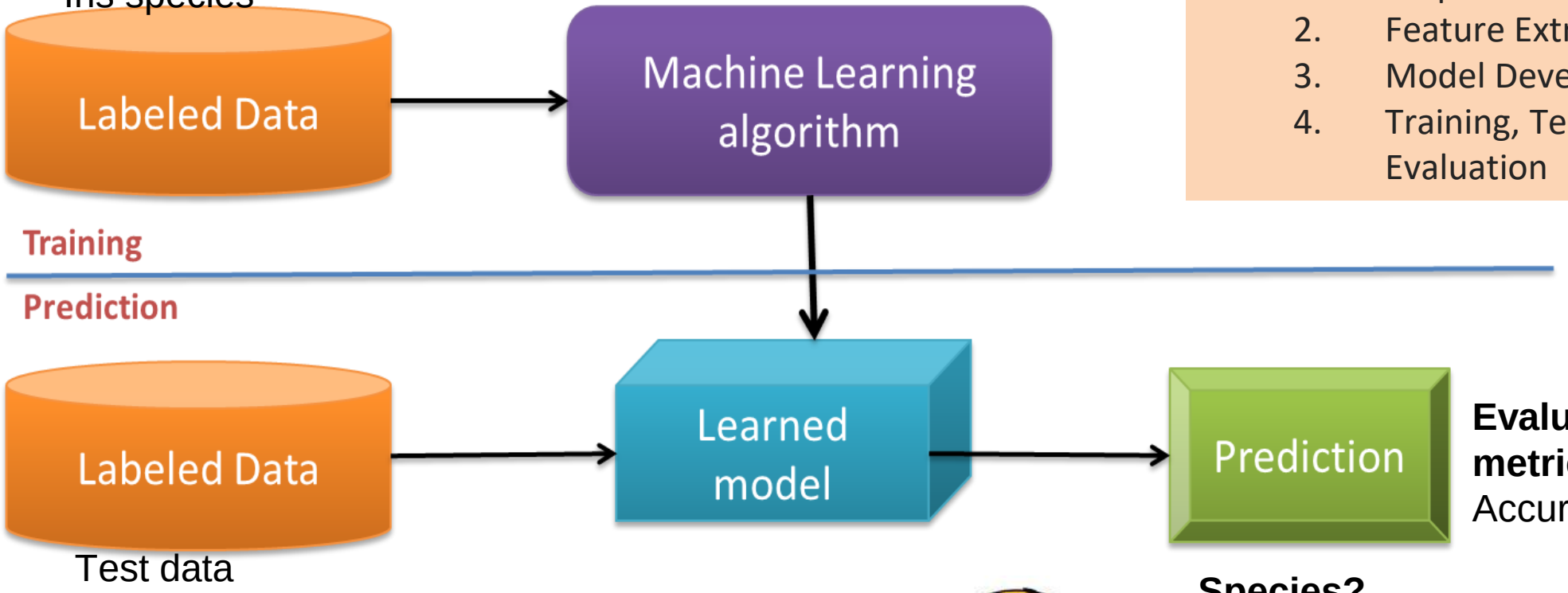

Test data

Evaluation metrics
Accuracy=98%

Species?

98% of the predictions by the model are correct!!

Supervised Learning (Classification)

Input features:
Sepal length, Sepal width, Petal length, petal width
Label:
Iris species

General methodology
1. Data Collection and Preprocessing
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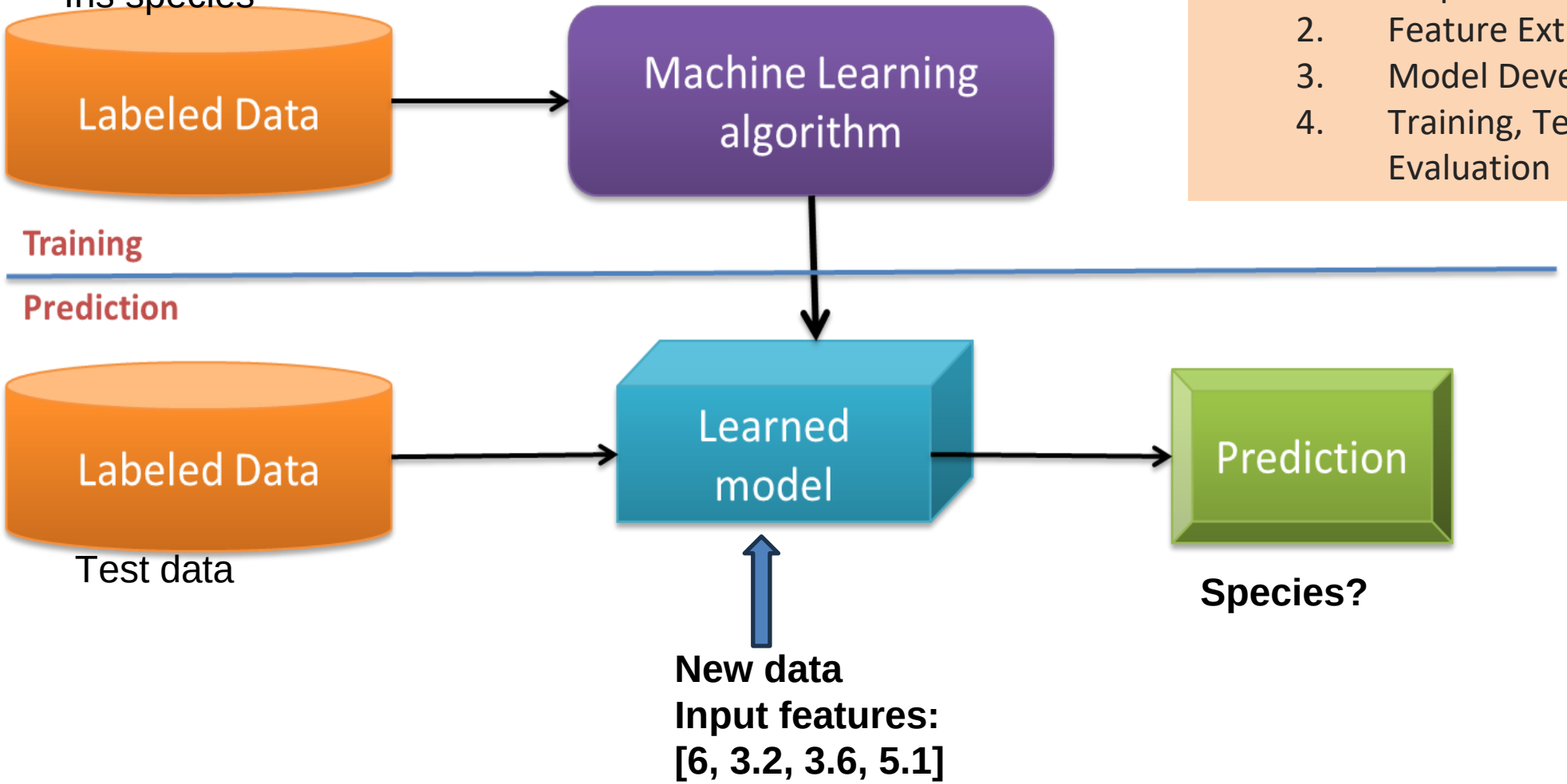
4. Training, Testing and Evaluation

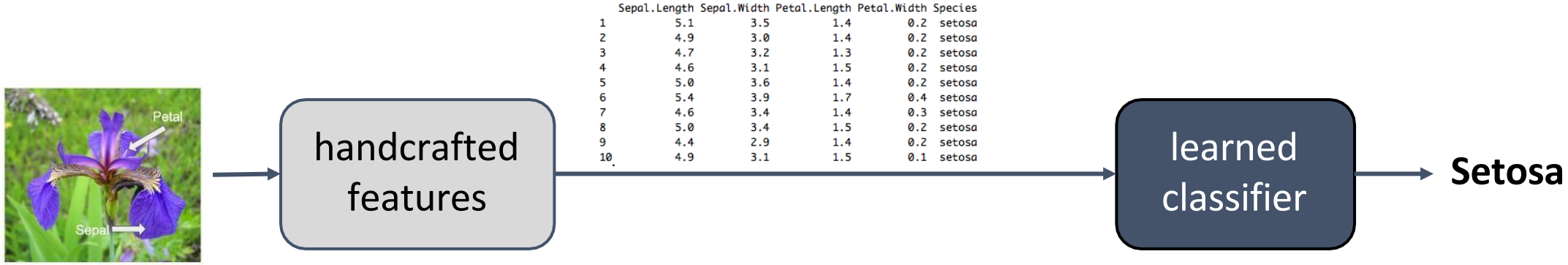


What is deep learning?

Deep learning is a subfield of machine learning focusing on learning data representations as successive layers of increasingly meaningful representations.

Deep Learning uses **artificial neural networks** to learn from lots of data without needing explicit programming.

“Traditional” machine learning:



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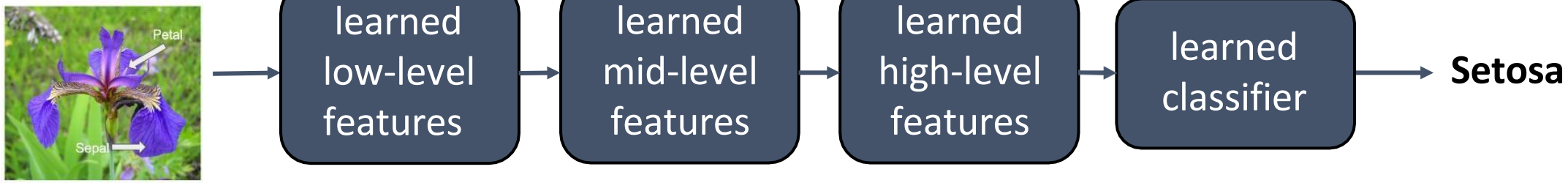
10	4.9	3.1	1.5	0.1	setosa

Deep, “end-to-end” learning:



Supervised Learning

Model → Cat or Dog

Image recognition / classification

"How are you?" → Model → "Wie geht's dir?"

Machine translation

Model → "Hello"

Speech recognition

"How are you?" → Model → "I am fine thank you"

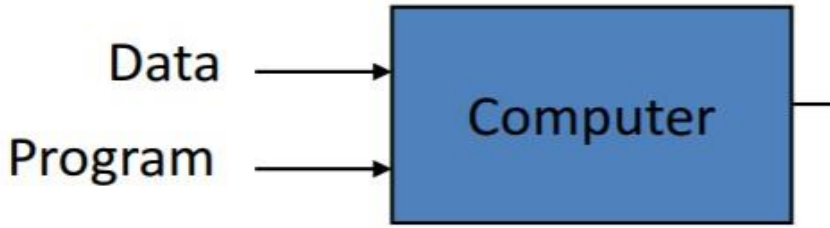
Conversational agent / chatbot

Why deep learning?

- Deep learning is a subset of machine learning involving neural networks with many layers
- **Capabilities:**
  - Handles large and complex datasets
  - Extracts meaningful patterns and insights from diverse data
    - Example: chemical structures, biological information, and patient data (Drug Response Prediction)
  - Enhances predictive accuracy

Programming vs Learning

Traditional Programming



Machine Learning