



Introduction to Intelligent User Interfaces

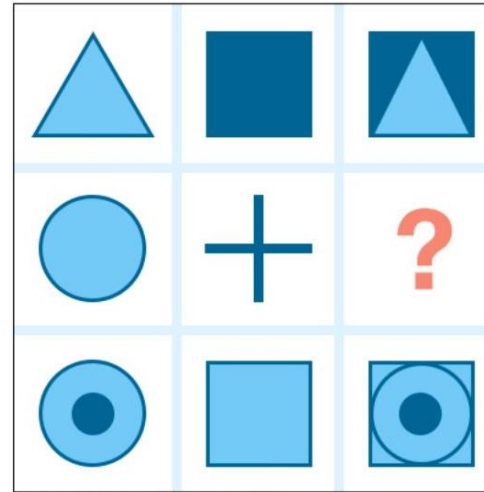
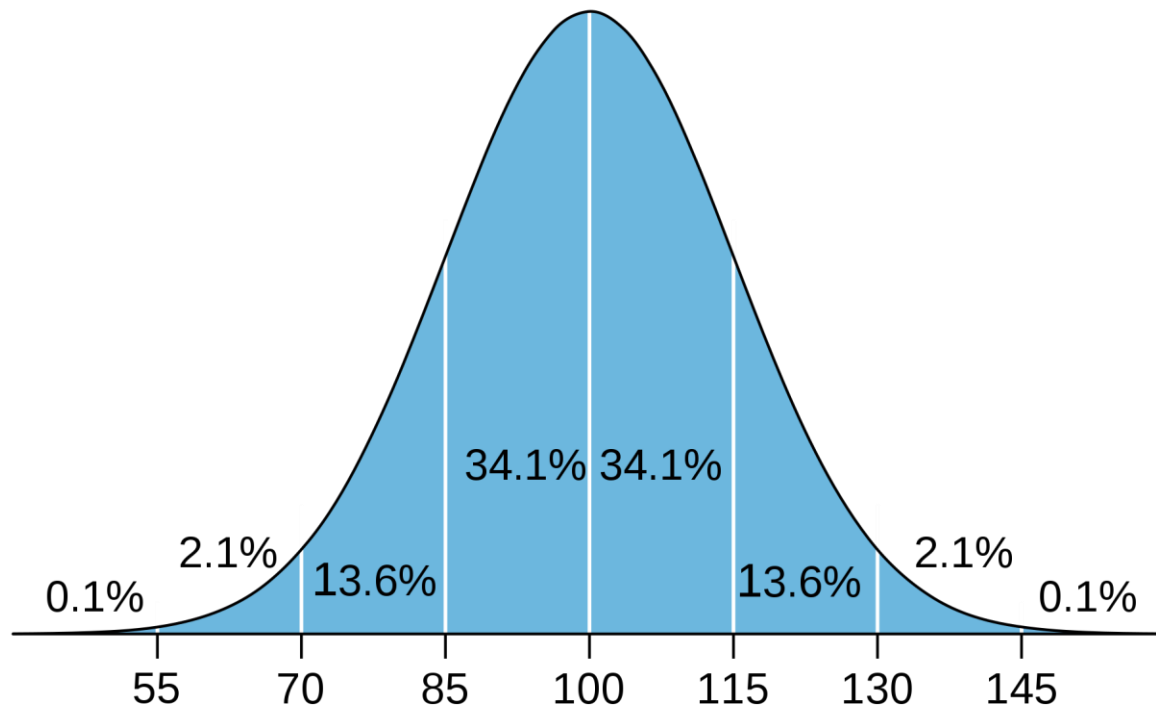
Artificial Intelligence: An Overview for HCI

Image Source

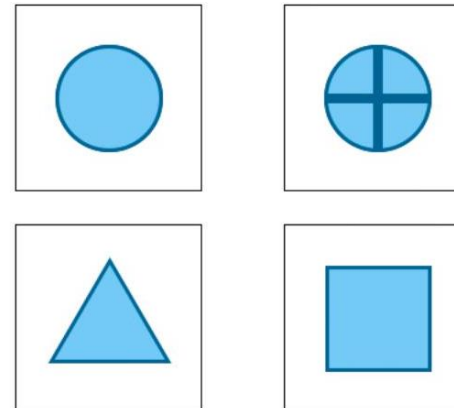
What is considered Artificial Intelligence?

What is considered Artificial Intelligence?

What is Human Intelligence?



Which figure fits?



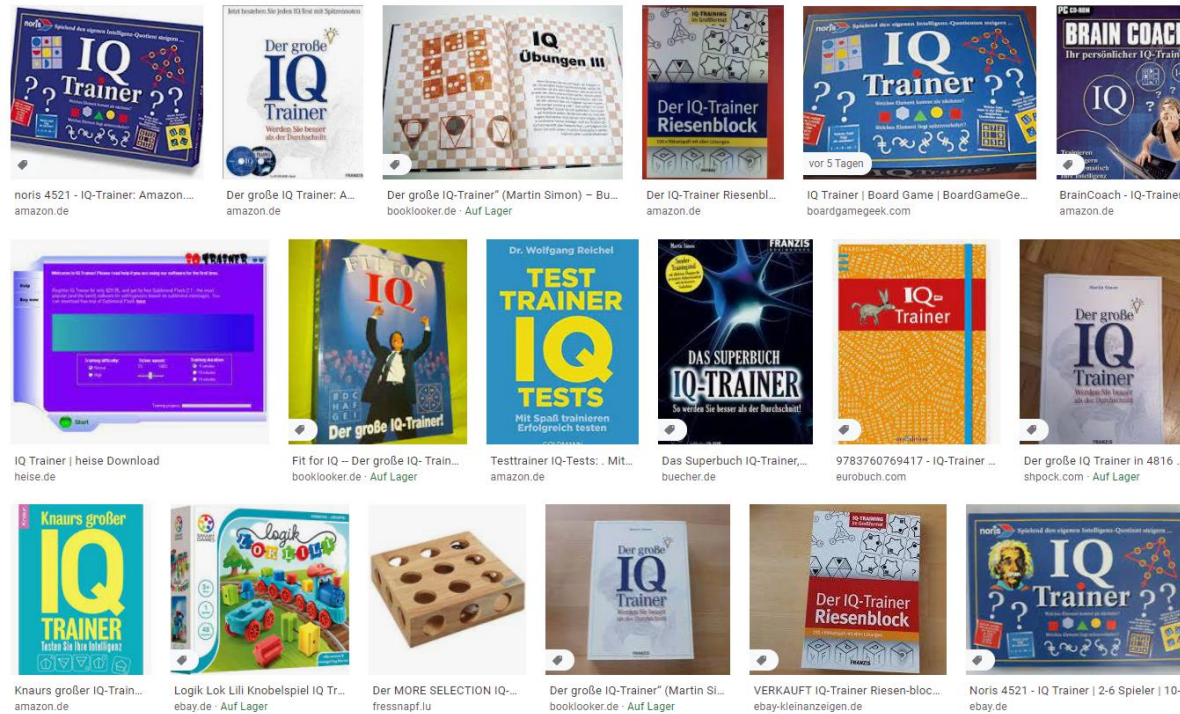
What is in an IQ test?

Many different types... typical questions include:

- Finding Analogies (math and verbal)
 - *Pen and writing, cup and ???*
- Finding / extending Pattern (graphical and math)
 - *45 ... 40 ... 60 ... 55 ... 75 ... 70 ... ???*
- Classification tasks
 - *Make two groups: apple, plate, grape, cake, spoon, knife*
- Making sense spatial and visual representations
- Reasoning and logical
- General knowledge

Is the IQ static or can it be learned?

- Google Search for IQ trainer...



What is...

Mini In-Class Exercise

- Artificial intelligence
- Machine Learning
- Write a definition for one of the term
 - Time limit is 3 minutes
 - No more than 20 words

Artificial Intelligence?

- Artificial Narrow Intelligence (also Weak AI)
 - Solves very specific and well described problems in a specific domain
- Artificial General Intelligence (also Strong AI)
 - An artificial intelligence that has the ability to mimic human intelligence
 - Its behavior cannot be distinguished by observation from a human
- Artificial Super Intelligence
 - An artificial intelligence that surpasses human intelligence




<http://www.geminoid.jp/en>

AI Knowledge Map: how to classify AI technologies

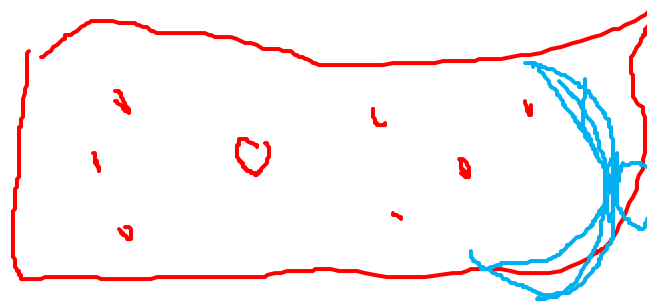
A sketch of a new AI technology landscape by Francesco Corea

■ Technologies

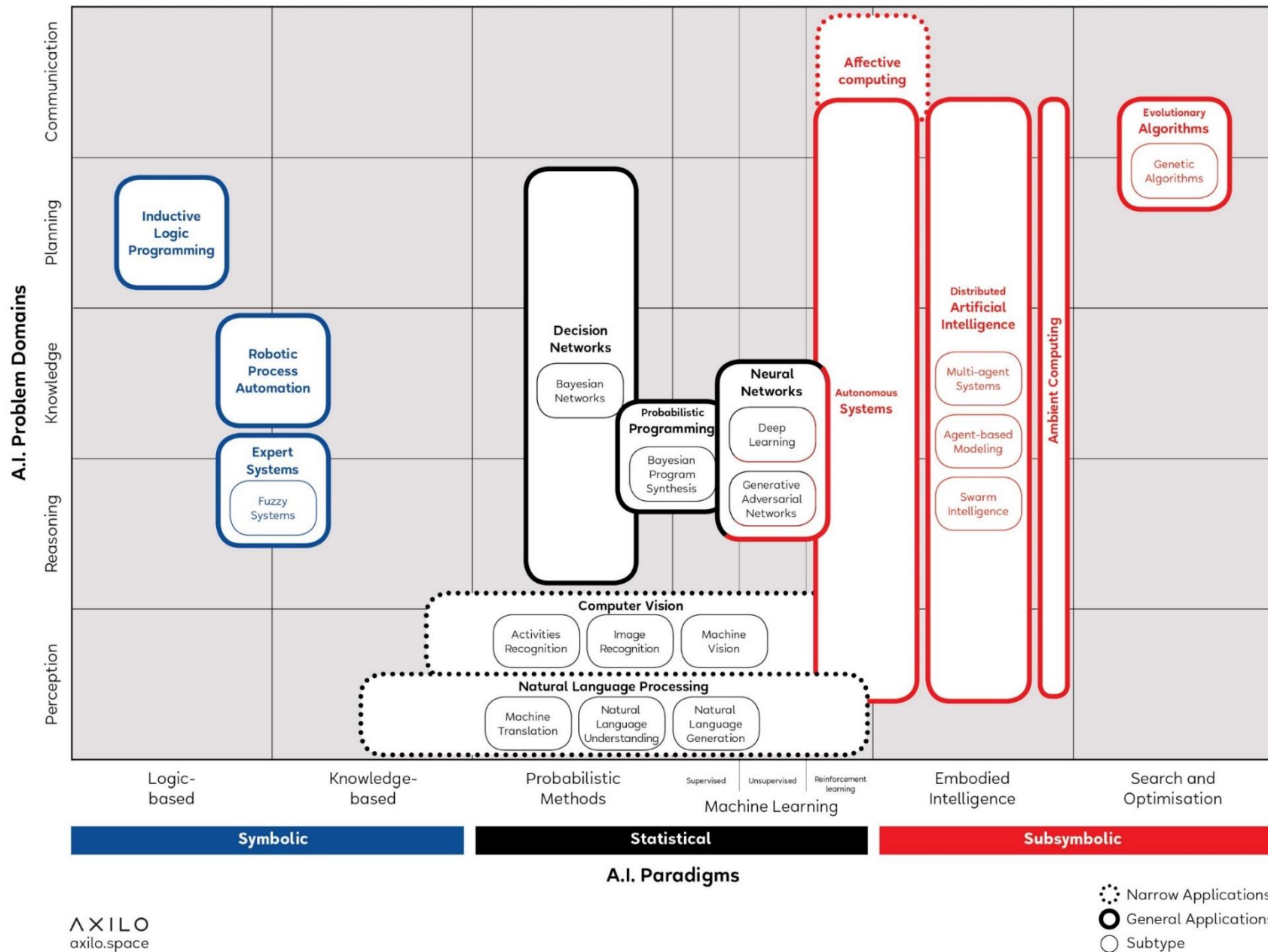
- Logic-based
- Knowledge-based
- Probabilistic methods
- Machine learning
- Embodied intelligence 
- Search and optimization

■ Domains

- Reasoning
- Knowledge
- Planning
- Communication
- Perception



https://medium.com/@Francesco_AI/ai-knowledge-map-how-to-classify-ai-technologies-6c073b969020



AXILO
axilo.space

AI Knowledge Map: how to classify AI technologies. A sketch of a new AI technology landscape Francesco Corea

AI Knowledge Map: how to classify AI technologies

A sketch of a new AI technology landscape by Francesco Corea

Technologies

- **Logic-based tools:** tools that are used for knowledge representation and problem-solving
- **Knowledge-based tools:** tools based on ontologies and huge databases of notions, information, and rules
- **Probabilistic methods:** tools that allow agents to act in incomplete information scenarios
- **Machine learning:** tools that allow computers to learn from data
- **Embodied intelligence:** engineering toolbox, which assumes that a body (or at least a partial set of functions such as movement, perception, interaction, and visualization) is required for higher intelligence
- **Search and optimization:** tools that allow intelligently searching through many possible solutions

https://medium.com/@Francesco_AI/ai-knowledge-map-how-to-classify-ai-technologies-6c073b969020

AI Knowledge Map: how to classify AI technologies

A sketch of a new AI technology landscape by Francesco Corea

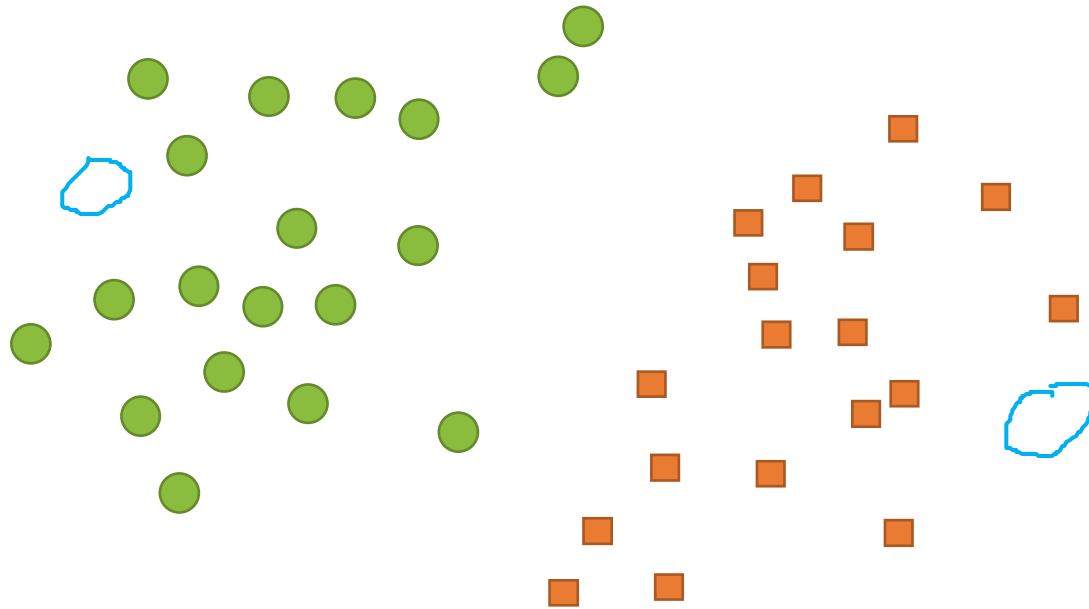
Domains

- **Reasoning:** the capability to solve problems
- **Knowledge:** the ability to represent and understand the world
- **Planning:** the capability of setting and achieving goals
- **Communication:** the ability to understand language and communicate
- **Perception:** the ability to transform raw sensorial inputs (e.g., images, sounds, etc.) into usable information

https://medium.com/@Francesco_AI/ai-knowledge-map-how-to-classify-ai-technologies-6c073b969020

Classification

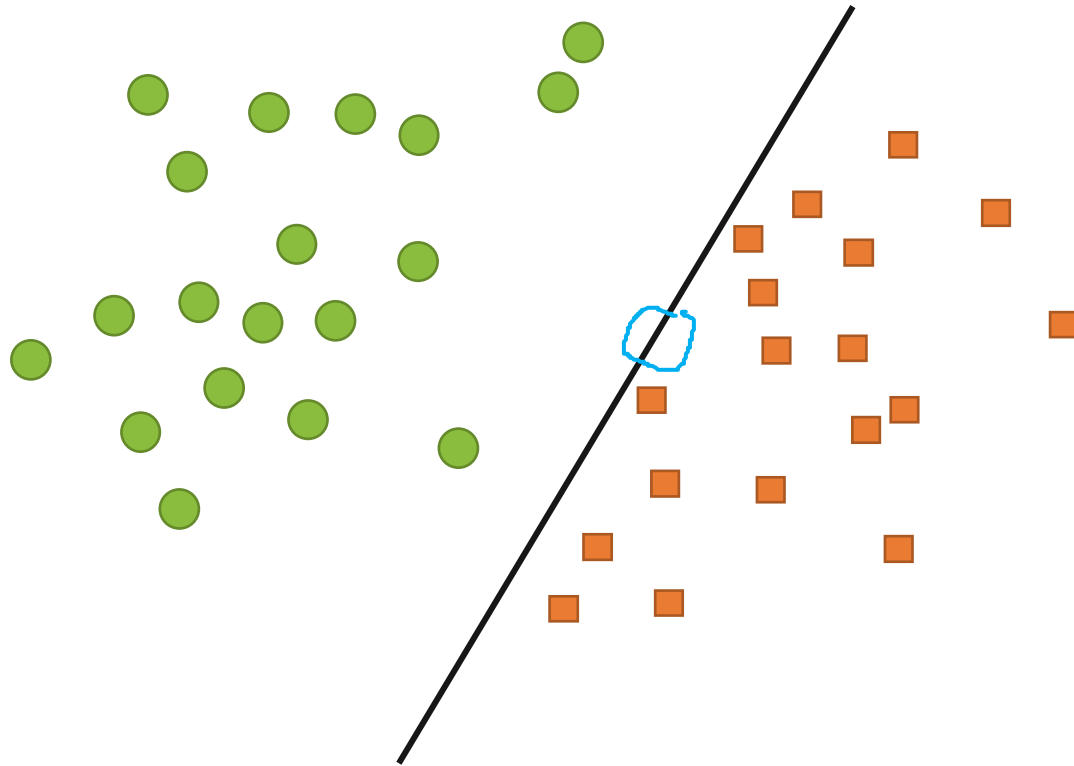
e.g. is an Email spam or not?



- These are your examples...
- How can we find a “line” that separates the two groups?

Classification

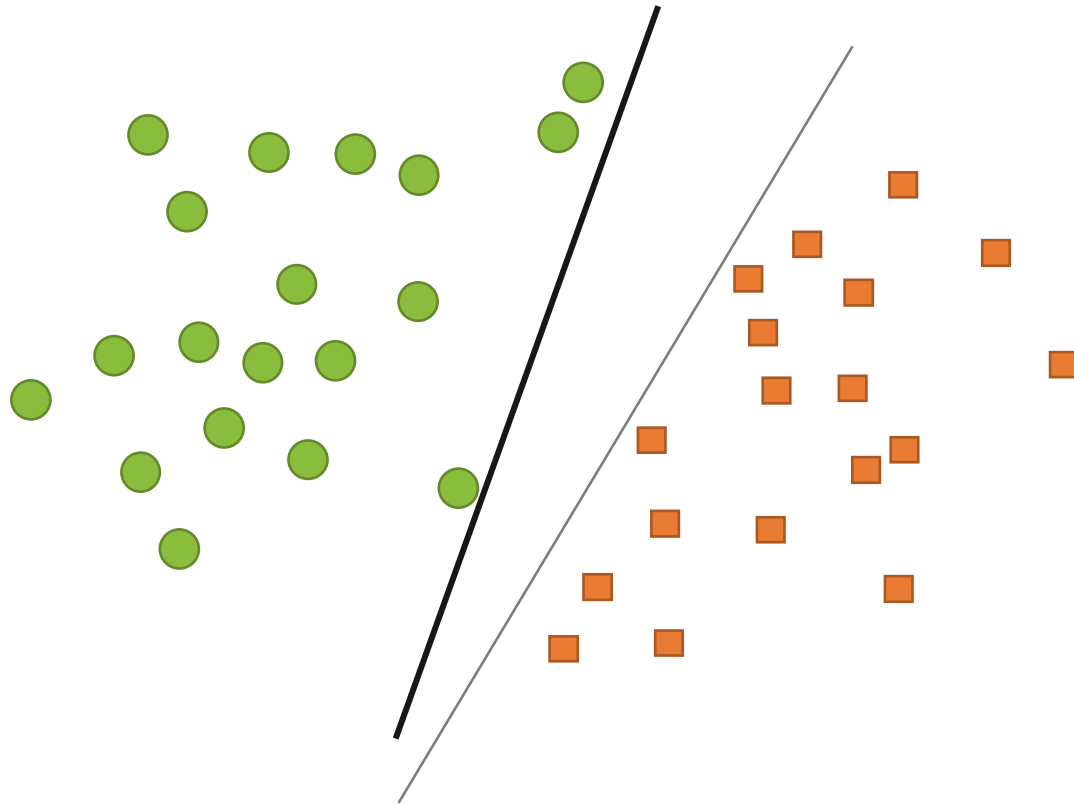
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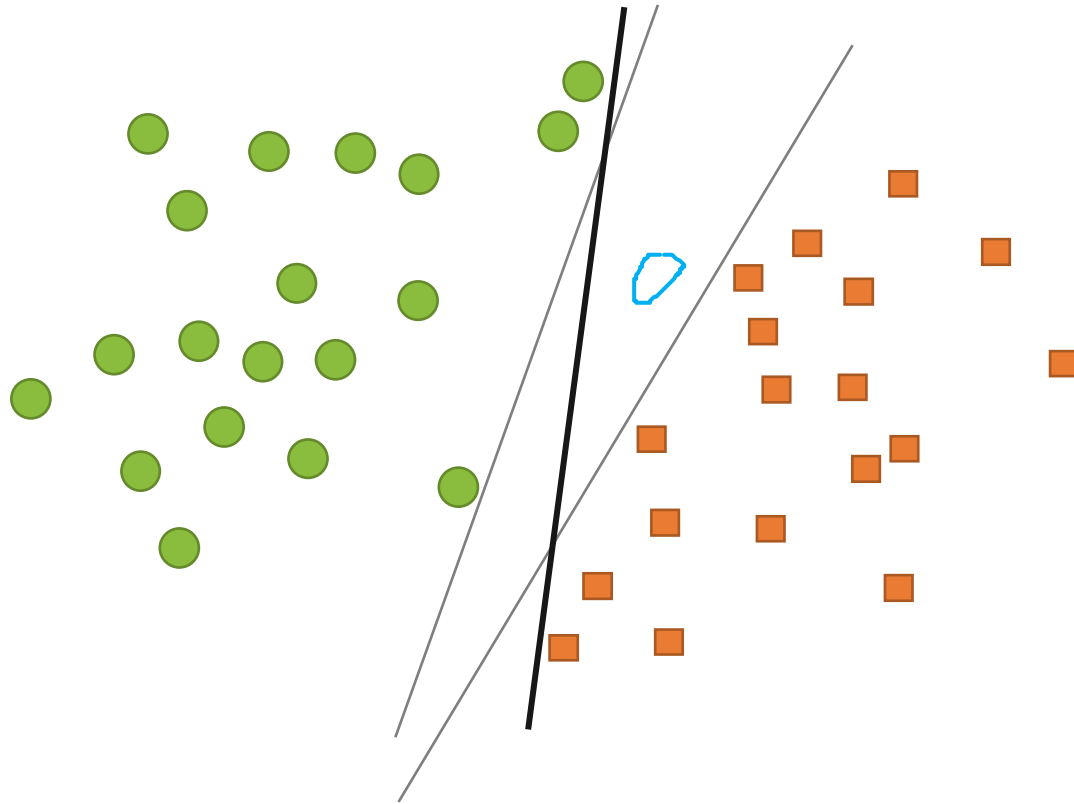
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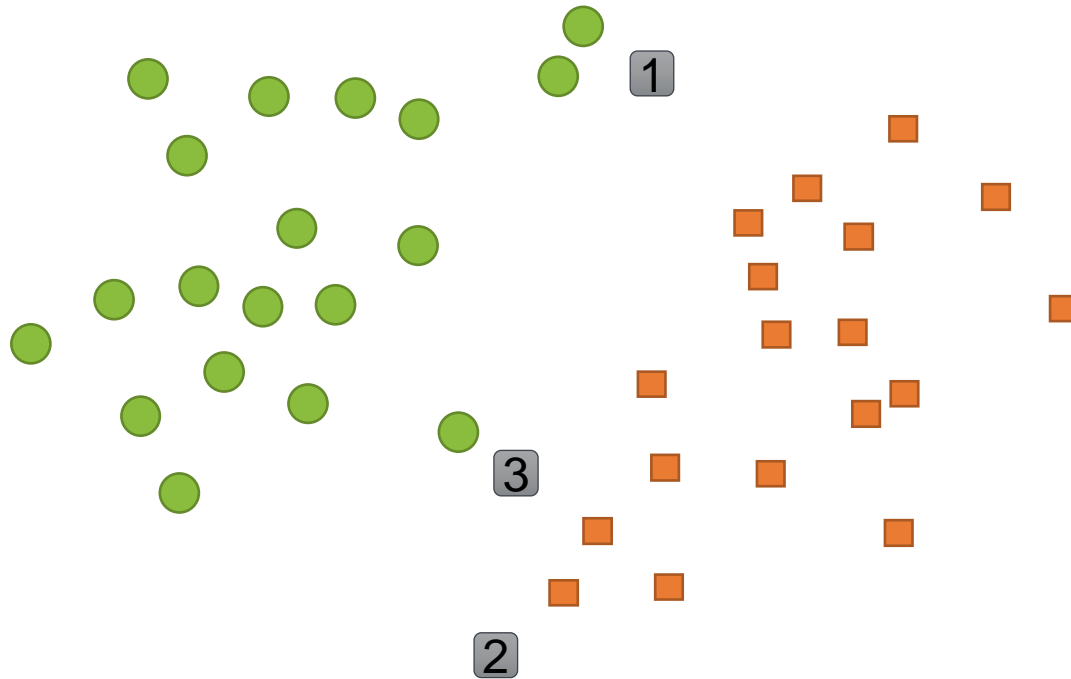


- These are your examples...
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Classification

e.g. is an Email spam or not?

- How will you classify the new data points?



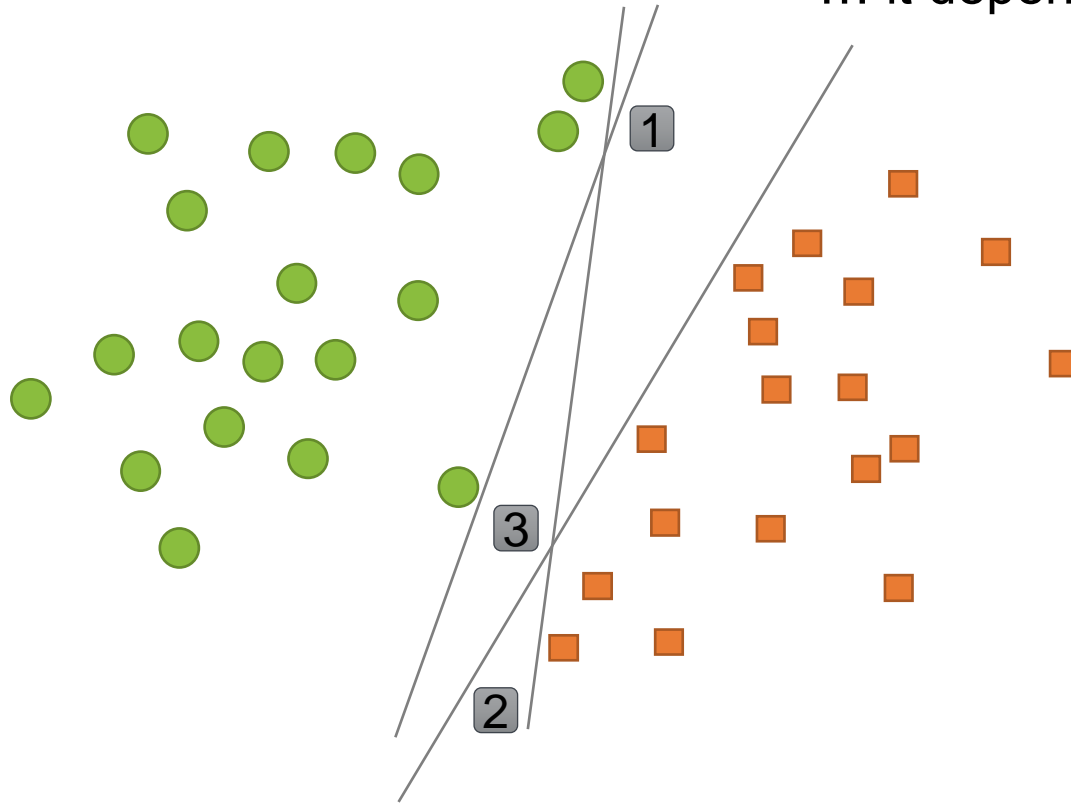
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Classification

e.g. is an Email spam or not?

- How will you classify the new data points?

... it depends on your “line”



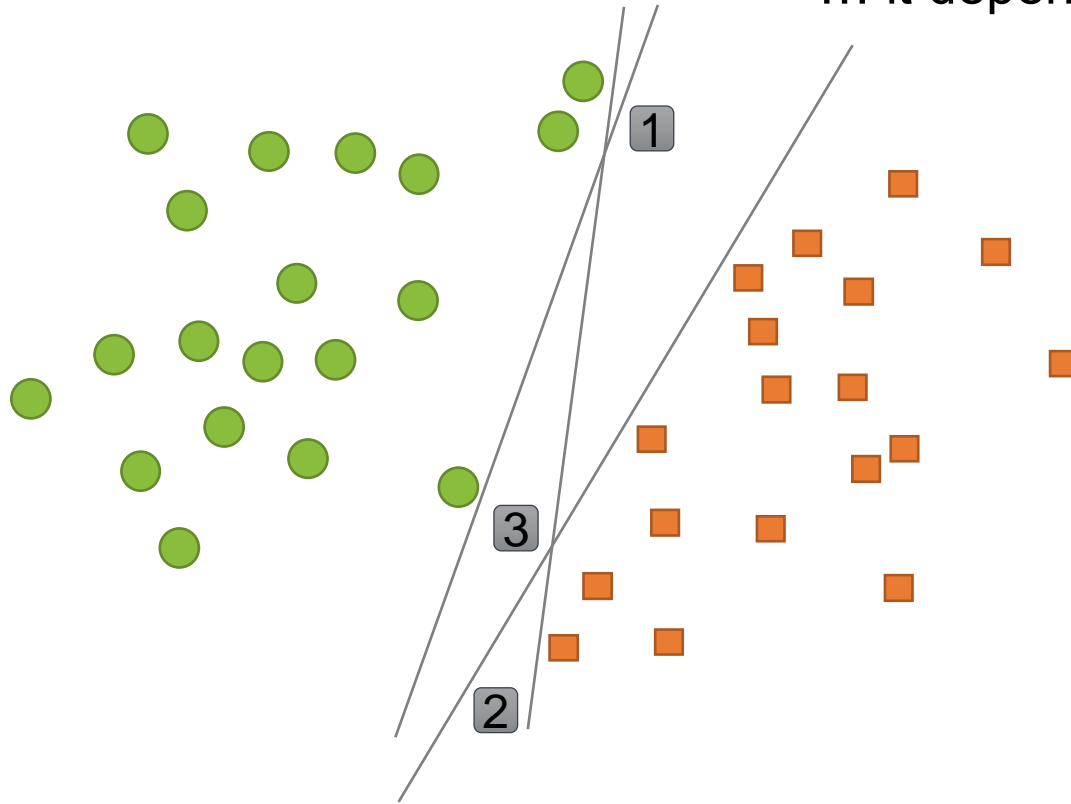
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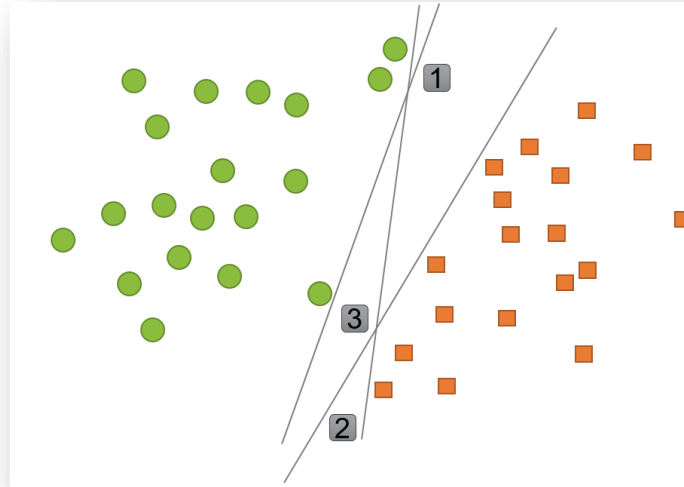


- These are your examples...
- How can we find a “line” that separates the two groups?

Classification

Example: Support Vector Machines (SVM)

- Determine whether a given data point belongs to a certain class or not
- Supervised method:
 - First training a classifier model on data points for which the class is known (e.g. a set of emails that are labeled as spam or not spam)
 - Then use the model to determine the class of new, unseen data-points
- Find the boundary line that separates two classes
- The boundary line should create a maximum separation between the classes

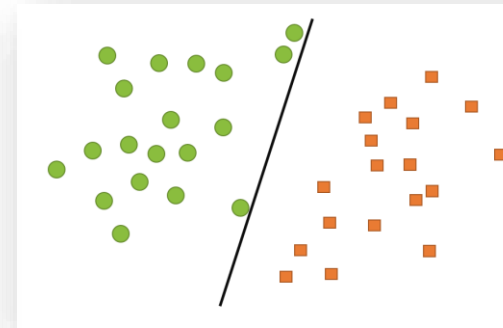
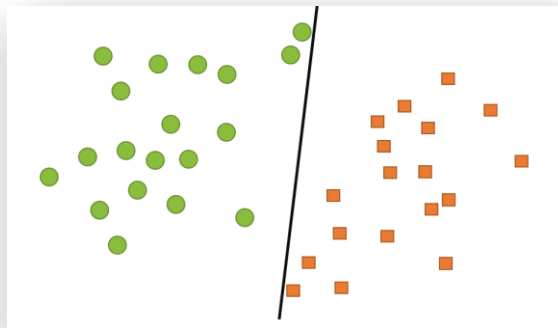
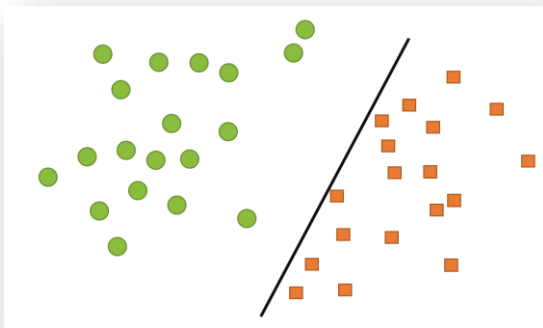
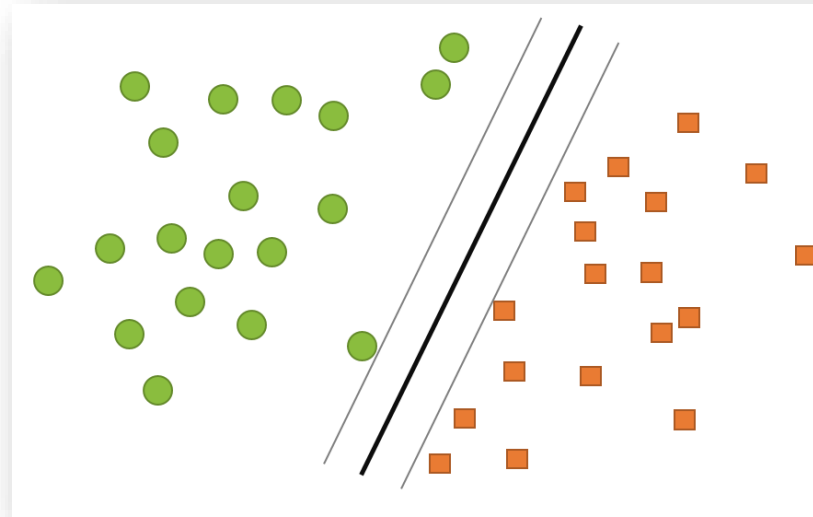


<https://www2.deloitte.com/nl/nl/pages/data-analytics/articles/part-2-artificial-intelligence-techniques-explained.html#>

Classification

Example: Support Vector Machines (SVM)

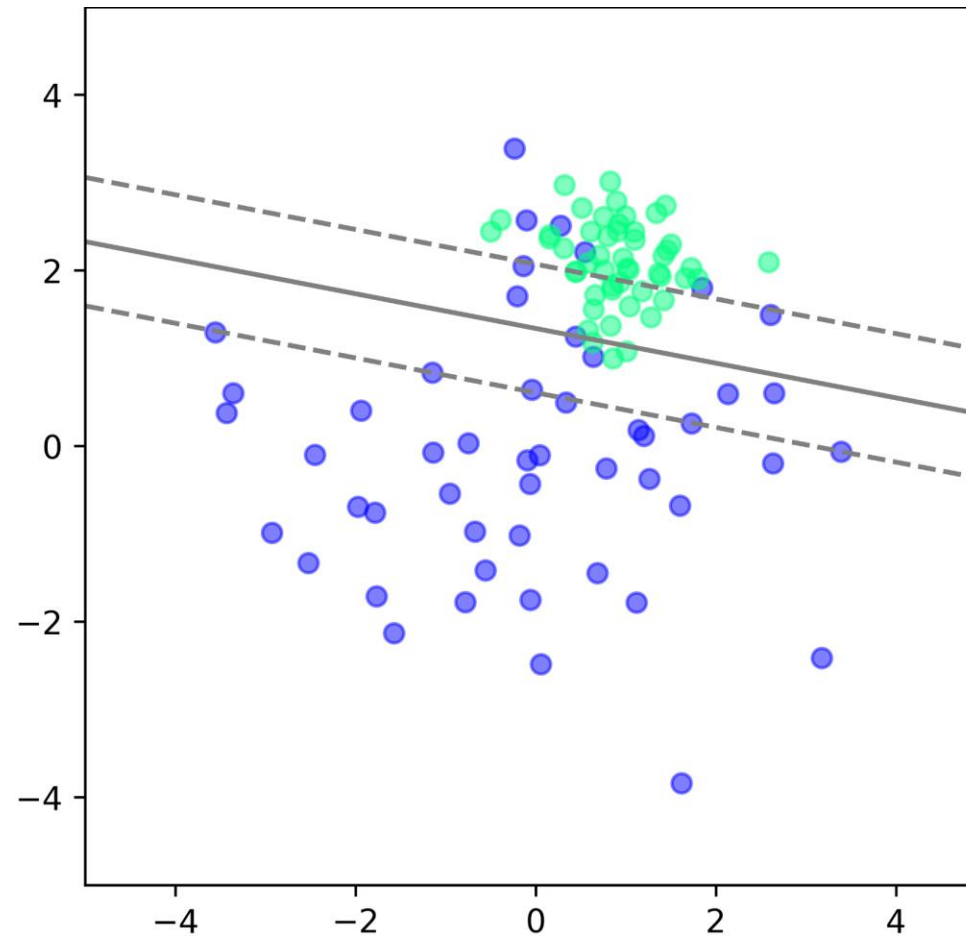
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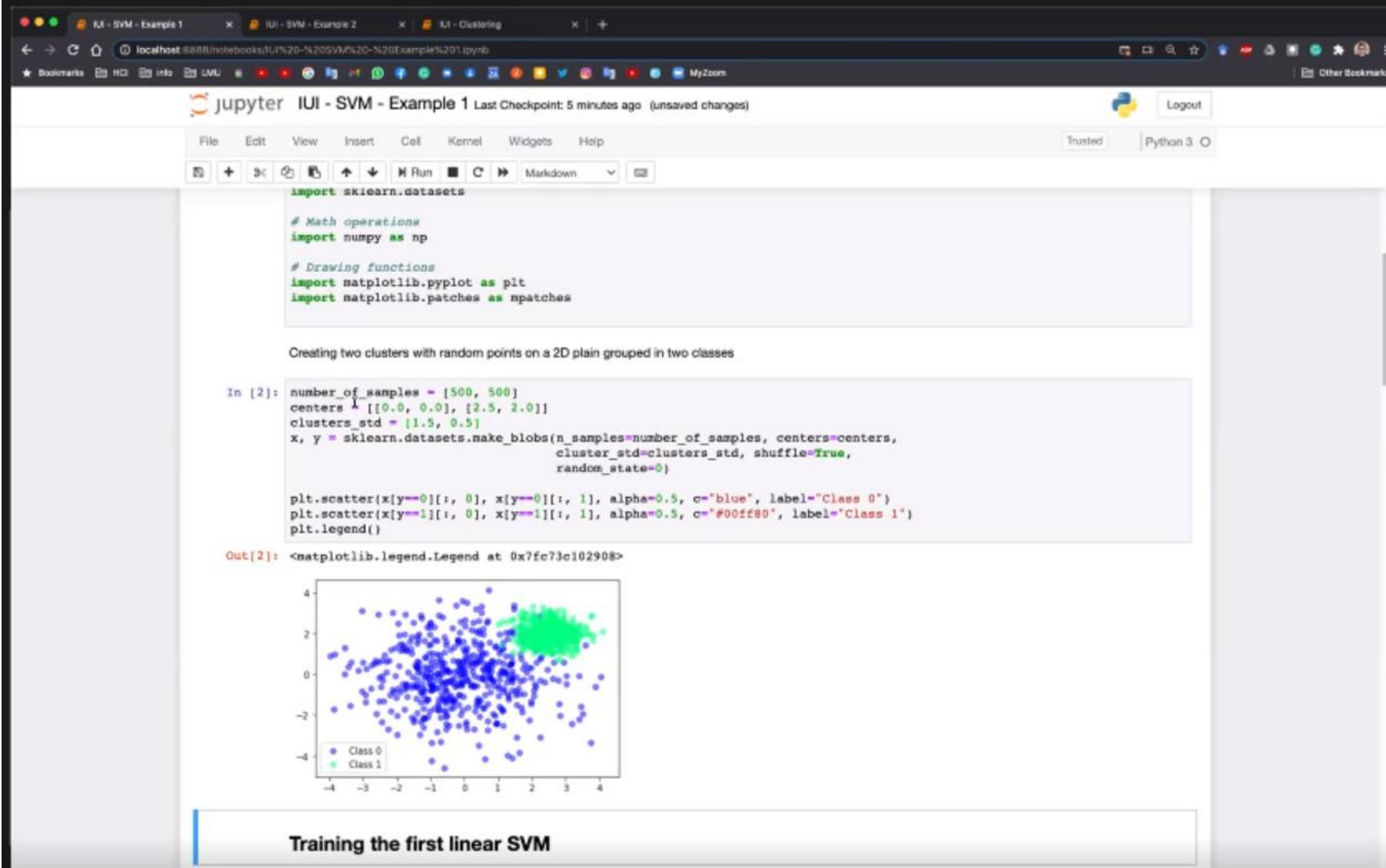


Live Coding Example 1

SVM in Python

- SVM with scikit-learn
<https://scikit-learn.org>





Supervised Learning vs. Unsupervised Learning

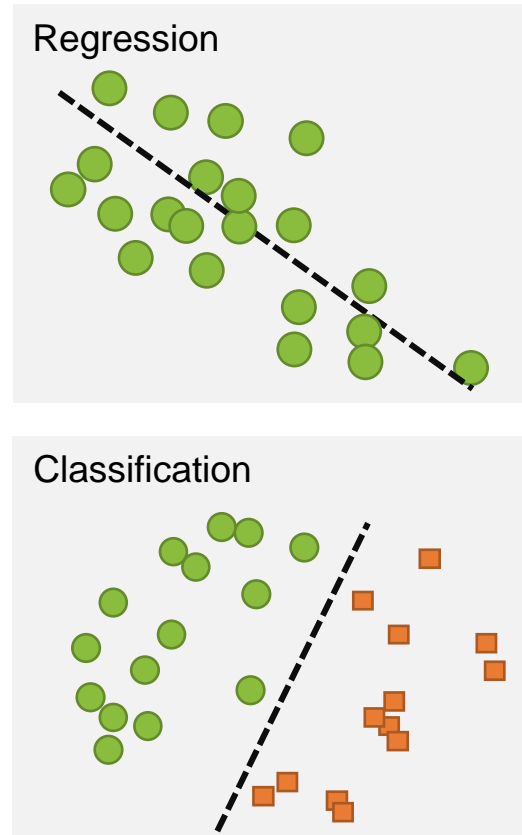
- Supervised Learning
 - We have a set of examples (data point) for which we know the ground truth (knowledge about the group the data point belongs to)
 - Typically a data set with labels exists (or is created)
 - During learning the algorithm look at the data AND the desired outcome and learns to associated them
 - Learning / preparation is done with a learning set
 - It is tested with a set that has not been used for learning
- Unsupervised learning
 - We may not know what class or group a data point belongs to
 - It may not be clear how many classes exist
 - The goal is to infer the natural structure present within a set of data points

<https://towardsdatascience.com/supervised-vs-unsupervised-learning-14f68e32ea8d>

Supervised Learning

“Supervised learning is typically done in the context of classification, when we want to map input to output labels, or regression, when we want to map input to a continuous output. Common algorithms in supervised learning include logistic regression, naive bayes, support vector machines, artificial neural networks, and random forests. In both regression and classification, the goal is to find specific relationships or structure in the input data that allow us to effectively produce correct output data. Note that “correct” output is determined entirely from the training data, so while we do have a ground truth that our model will assume is true, it is not to say that data labels are always correct in real-world situations. Noisy, or incorrect, data labels will clearly reduce the effectiveness of your model.”

<https://towardsdatascience.com/supervised-vs-unsupervised-learning-14f68e32ea8d>



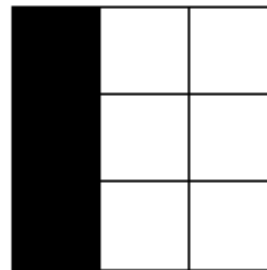
Live Coding Example 2

H or L

Training Set

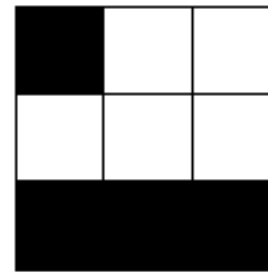


Class 'H'

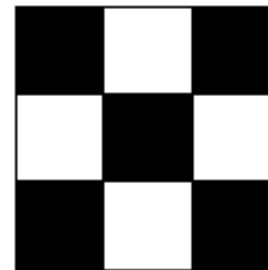


Class 'L'

Test Set



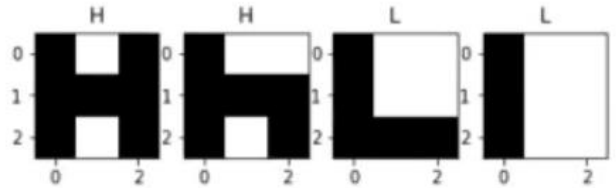
Test Pattern 1
Distorted 'L'



Test Pattern 2
Distorted 'H'

Jupyter Notebook Interface: UI - SVM - Example 2. Last Checkpoint: 8 minutes ago (unsaved changes). Python 3 kernel.

```
for i in range(4):
    ax[i].imshow(1-x[i].reshape((3,3)), cmap="gray")
    ax[i].set_title(value_map[y[i]])
```



Training

```
In [3]: classifier = sklearn.svm.SVC(gamma=0.001, kernel="linear")
        classifier.fit(x, y)
```

```
Out[3]: SVC(gamma=0.001, kernel='linear')
```

Testing

```
In [ ]: x_test = np.array([[1,0,0,0,0,0,1,1,1], [1,0,1,0,1,0,1,0,1]])
        y_test = [1,0]
        fig, ax = plt.subplots(1,2)
```



Unsupervised Learning

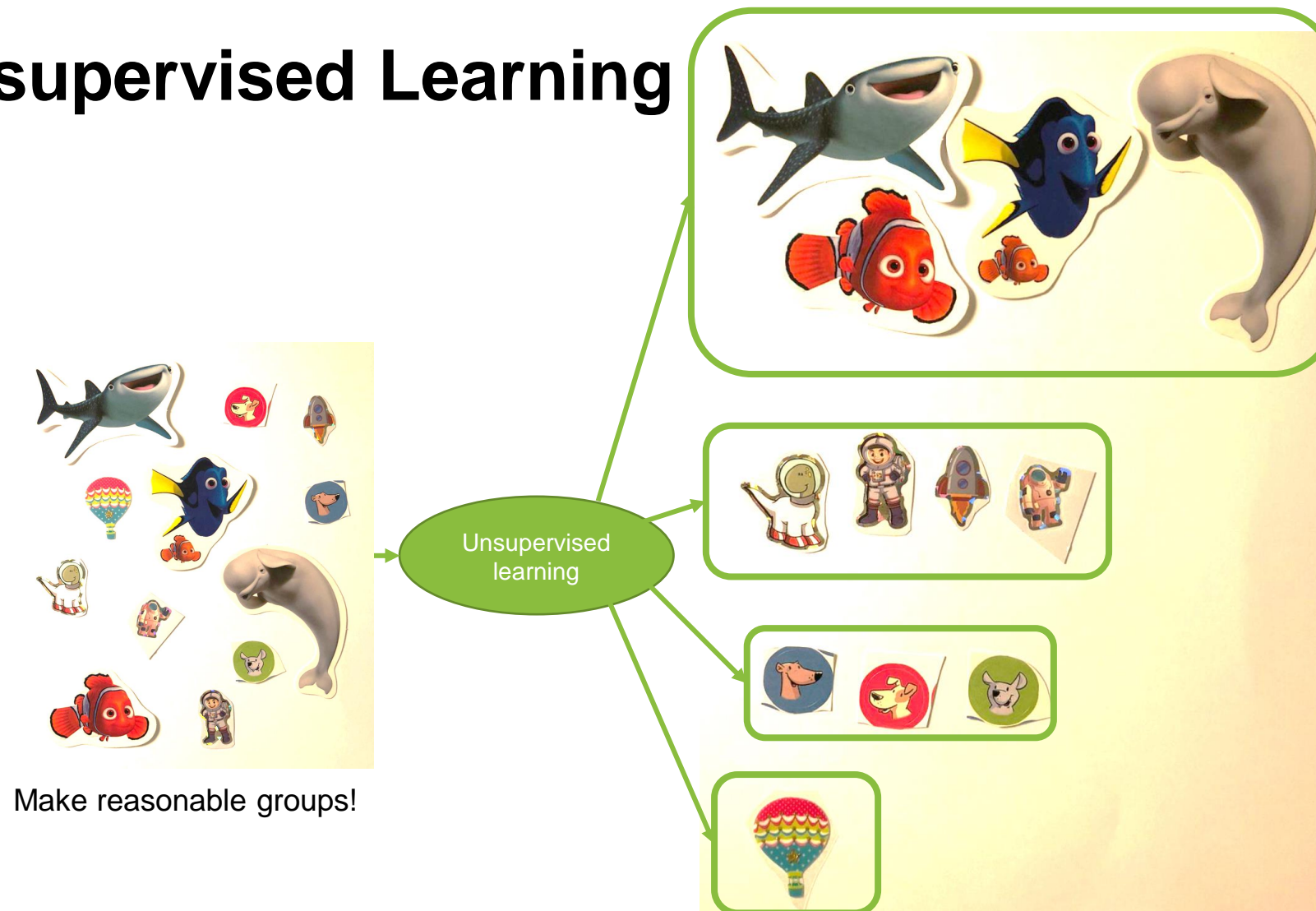
Exercise: make reasonable groups!

“The most common tasks within unsupervised learning are clustering, representation learning, and density estimation. In all of these cases, we wish to learn the inherent structure of our data without using explicitly-provided labels. Some common algorithms include k-means clustering, principal component analysis, and autoencoders. Since no labels are provided, there is no specific way to compare model performance in most unsupervised learning methods.

Two common use-cases for unsupervised learning are exploratory analysis and dimensionality reduction.”

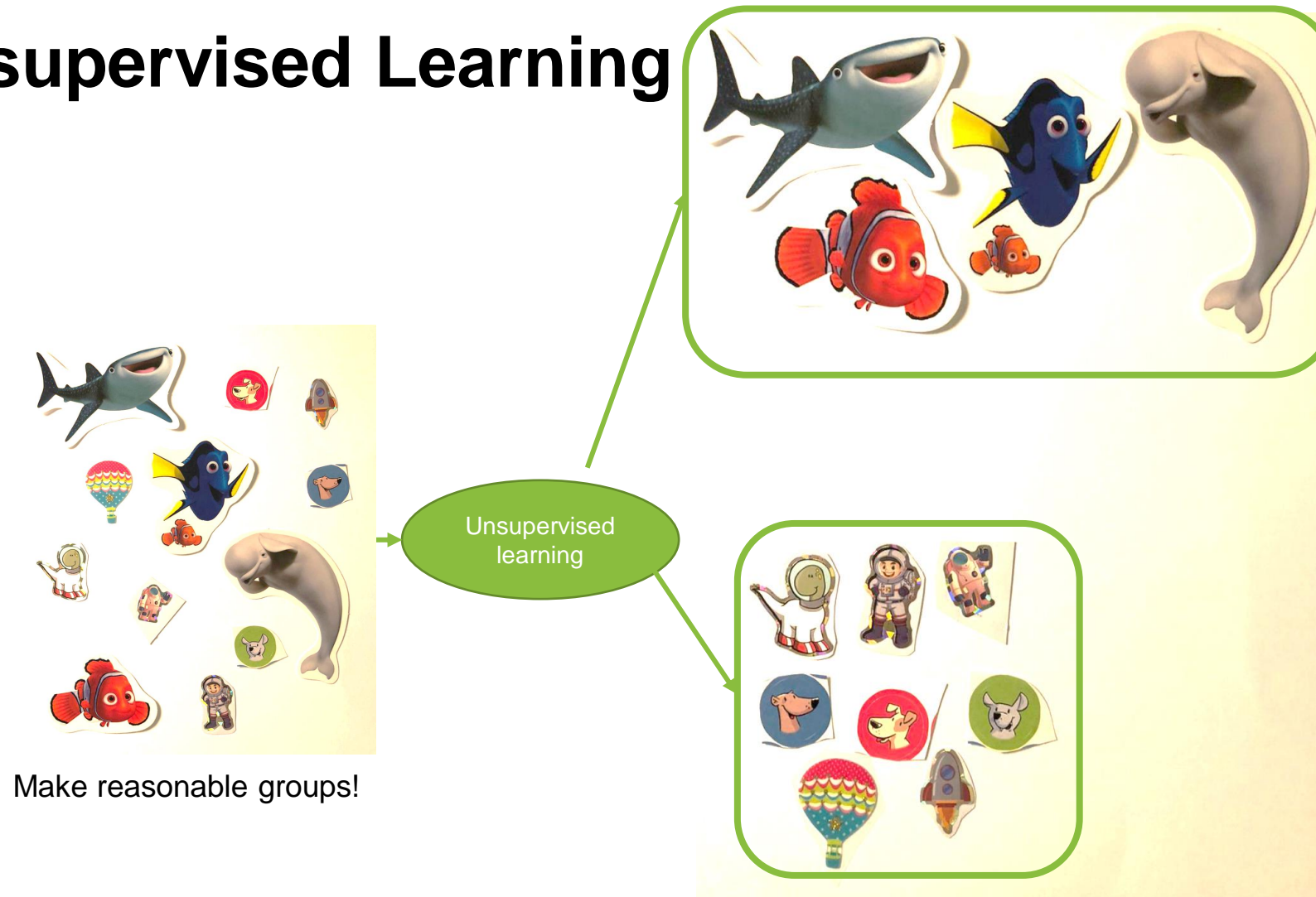


Unsupervised Learning



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Unsupervised Learning

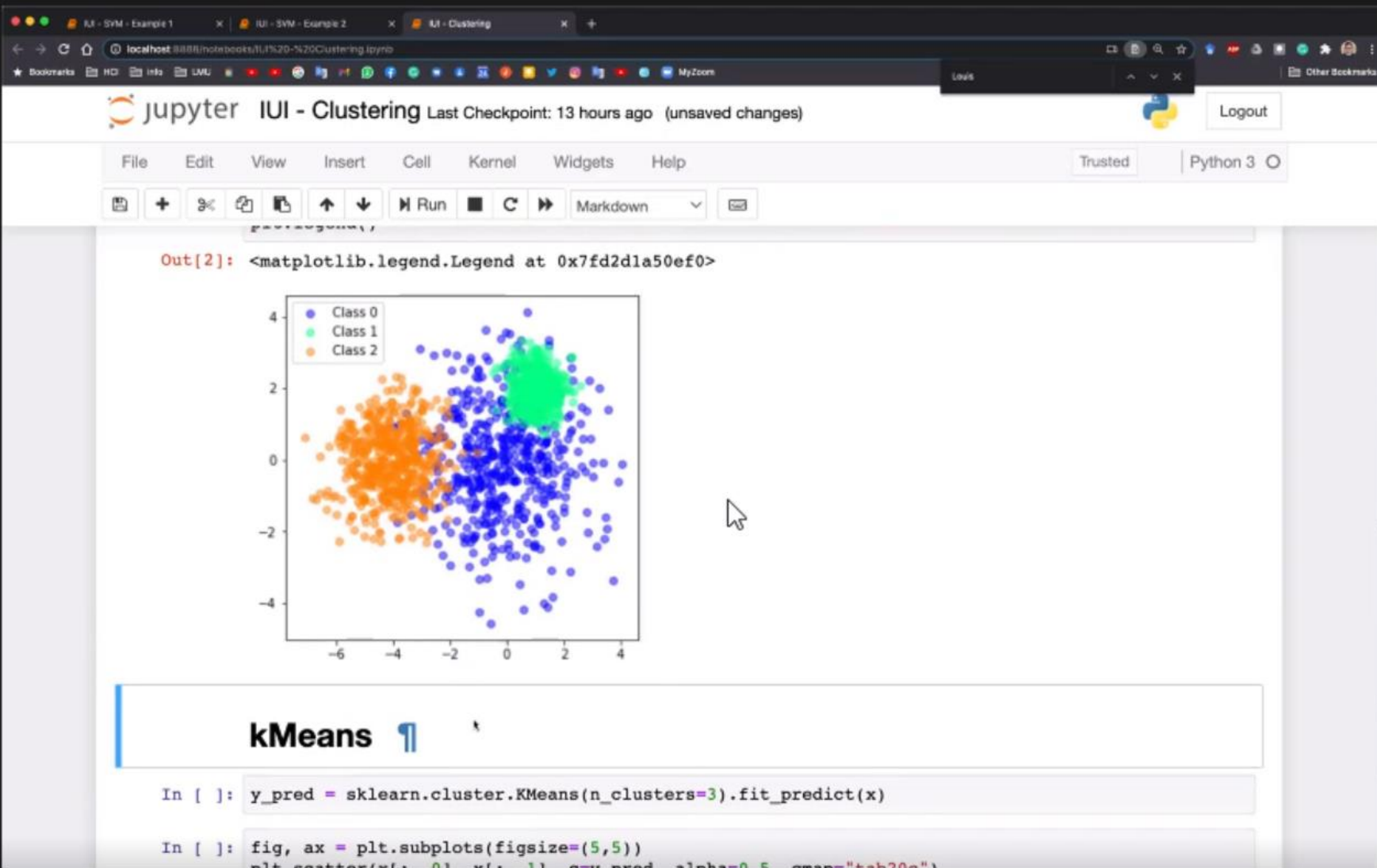


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Supervised Learning vs. Unsupervised Learning

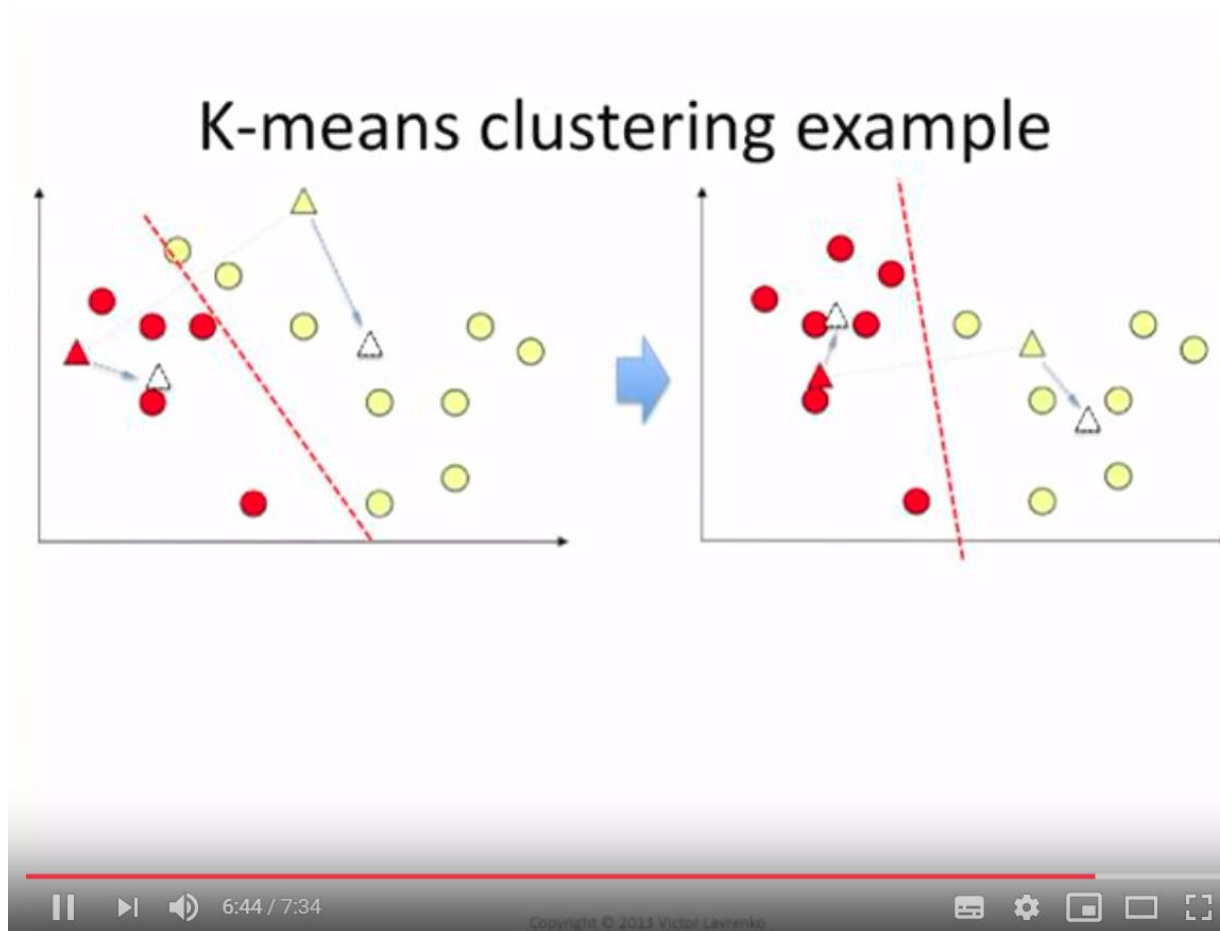
	Supervised Learning	Unsupervised Learning
Discrete	Classification or Categorization	Clustering
Continuous	Regression	Dimensionality reduction

<https://towardsdatascience.com/supervised-vs-unsupervised-learning-14f68e32ea8d>



Example: Clustering

<https://www.youtube.com/watch?v=aWzGGNrcic>



Discussion: Usable Security

- Detecting “the wrong user” trying to log in?
- Detecting a denial of service vs. a user who forgot her password?
- How can you do use machine learning to do this?
- How to use a cluster algorithm?

	Supervised Learning	Unsupervised Learning
Discrete	Classification or Categorization	Clustering
Continuous	Regression	Dimensionality reduction

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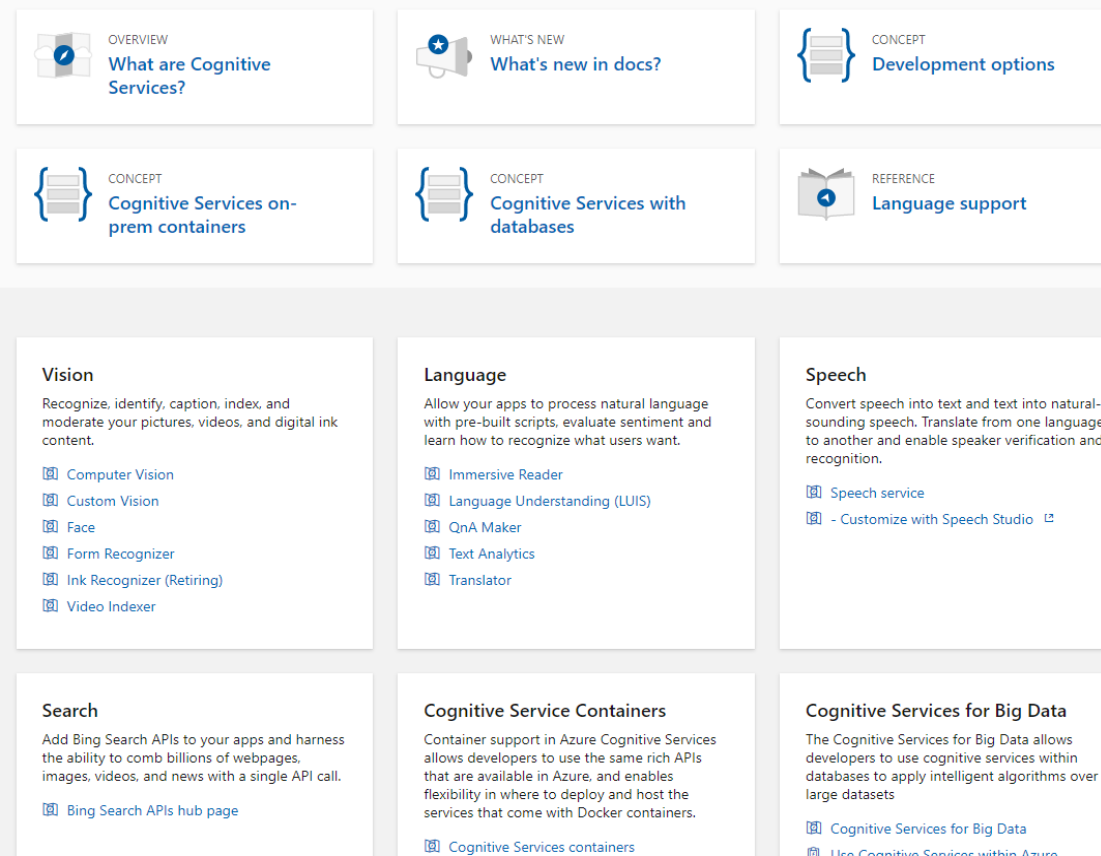
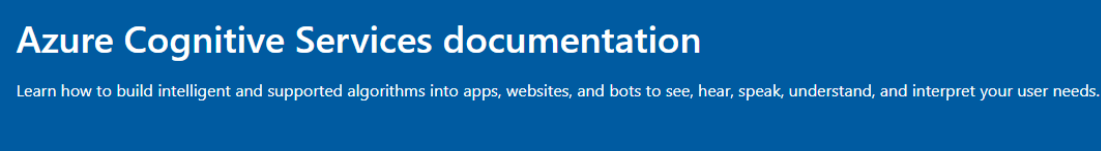
Implementing AI

- Libraries
- Frameworks
- Web Services

See Exercises and Tutorials...

Cloud Services

Example: Microsoft Cognitive Services



Cloud Services from:

- IBM
- Google
- Amazon
- Microsoft
- ... and many others

Why do people use them?

What is the risk?

<https://docs.microsoft.com/en-us/azure/cognitive-services/>

Examples Text Analytics

Identification of the Language

- Can tell what language the text is, e.g. English, German, Spanish,...
- Relevant for understanding and translation
- Example (Online) APIs:
 - <https://console.bluemix.net/apidocs/language-translator>
 - <https://docs.microsoft.com/en-us/azure/cognitive-services/translator/>
 - <https://cloud.google.com/translate/docs/basic/detecting-language>
 - <https://pypi.org/project/langdetect/>

To detect the language of the text:

```
>>> from langdetect import detect
>>> detect("War doesn't show who's right, just who's left.")
'en'
>>> detect("Ein, zwei, drei, vier")
'de'
```

To find out the probabilities for the top languages:

```
>>> from langdetect import detect_langs
>>> detect_langs("Otec matka syn.")
[sk:0.572770823327, pl:0.292872522702, cs:0.134356653968]
```


Discussion

Pros and Cons of Online APIs for AI/Machine learning?

How to Install Python

- Python with pip <https://www.python.org/downloads/>
- Python in the web via Google Colab <https://colab.research.google.com>
- Python via Anaconda www.anaconda.com