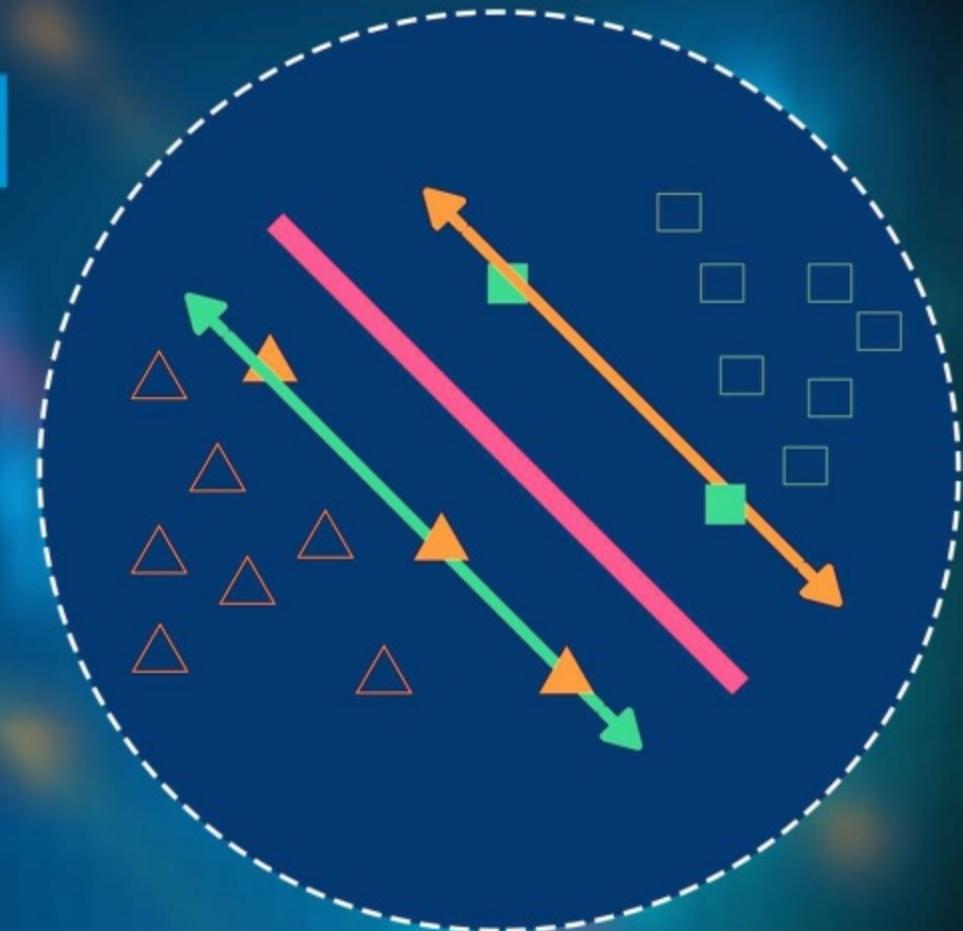


SUPPORT VECTOR MACHINE ALGORITHM



Applications of Support Vector Machine



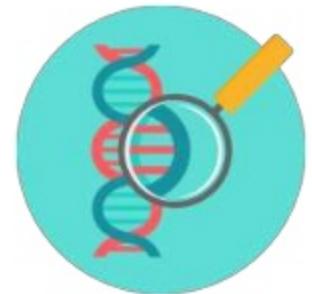
Face detection



Text and hypertext
categorization



Classification of images



Bioinformatics

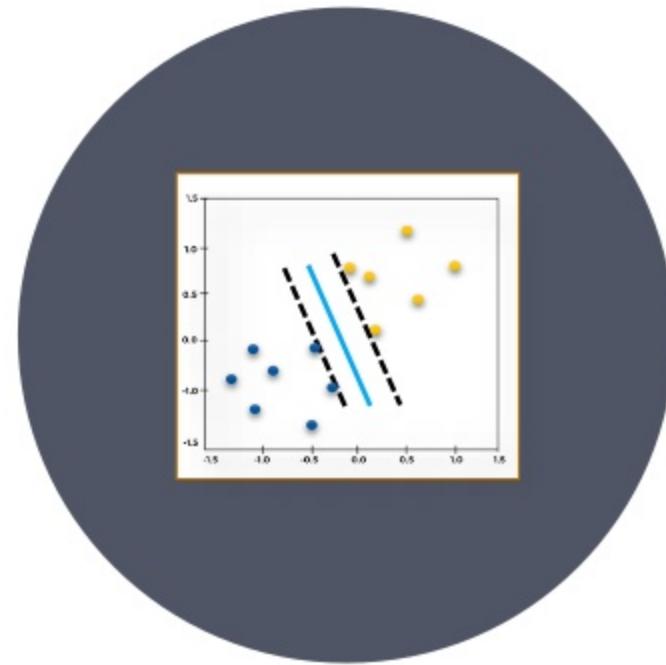
Agenda

- ▶ What is Machine learning?



Agenda

- ▶ What is Machine learning?
- ▶ Why Support Vector Machine?



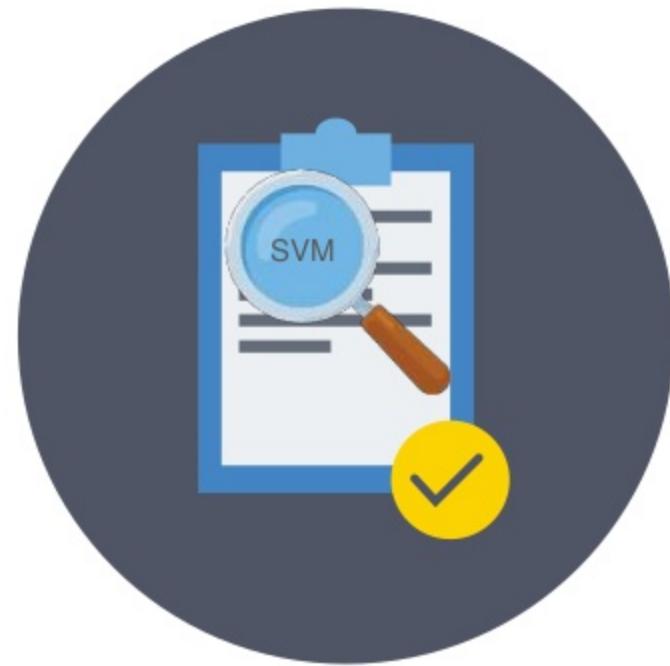
Agenda

- ▶ What is Machine learning?
- ▶ Why Support Vector Machine?
- ▶ What is Support Vector Machine?



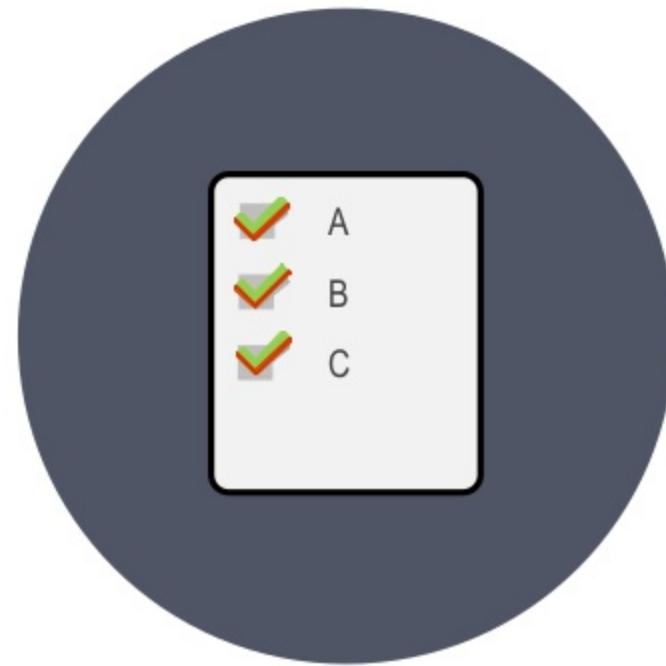
Agenda

- ▶ What is Machine learning?
- ▶ Why Support Vector Machine?
- ▶ What is Support Vector Machine?
- ▶ Understanding Support Vector Machine



Agenda

- ▶ What is Machine learning?
- ▶ Why Support Vector Machine?
- ▶ What is Support Vector Machine?
- ▶ Understanding Support Vector Machine
- ▶ Advantages of Support Vector Machine

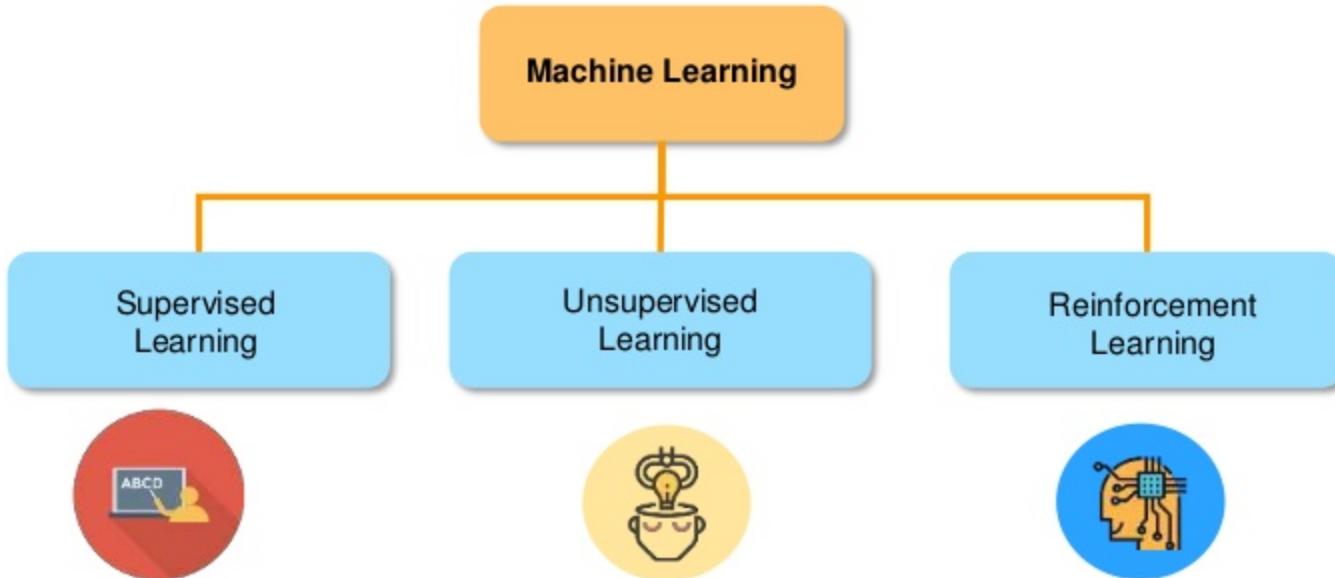


Agenda

- ▶ What is Machine learning?
- ▶ Why Support Vector Machine?
- ▶ What is Support Vector Machine?
- ▶ Understanding Support Vector Machine
- ▶ Advantages of Support Vector Machine
- ▶ Use Case in Python



What is Machine learning?

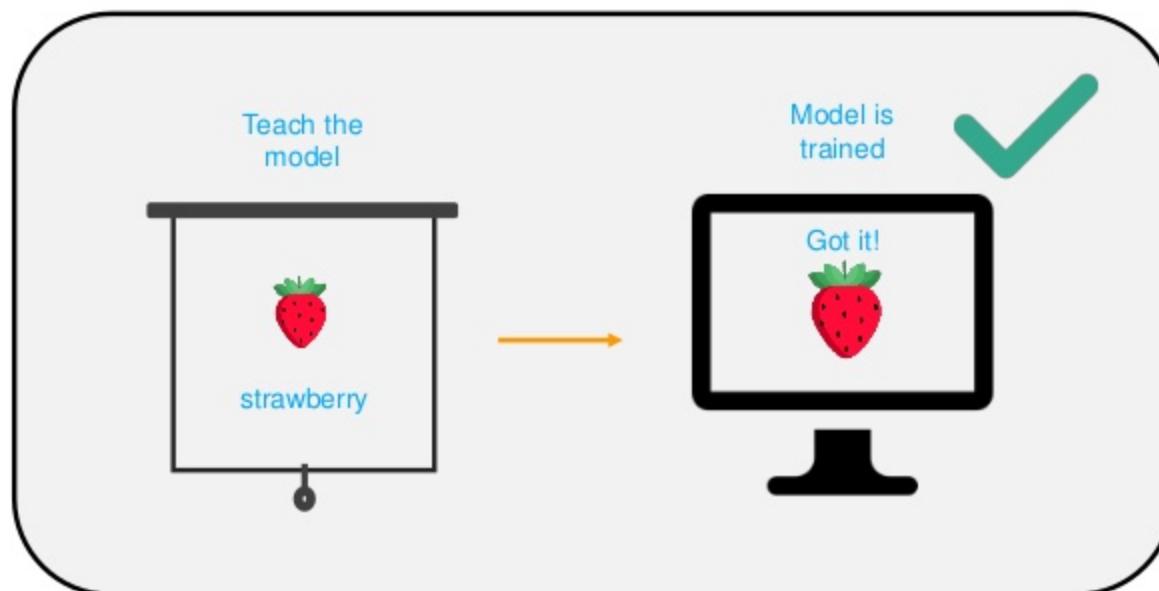


What is Machine learning?

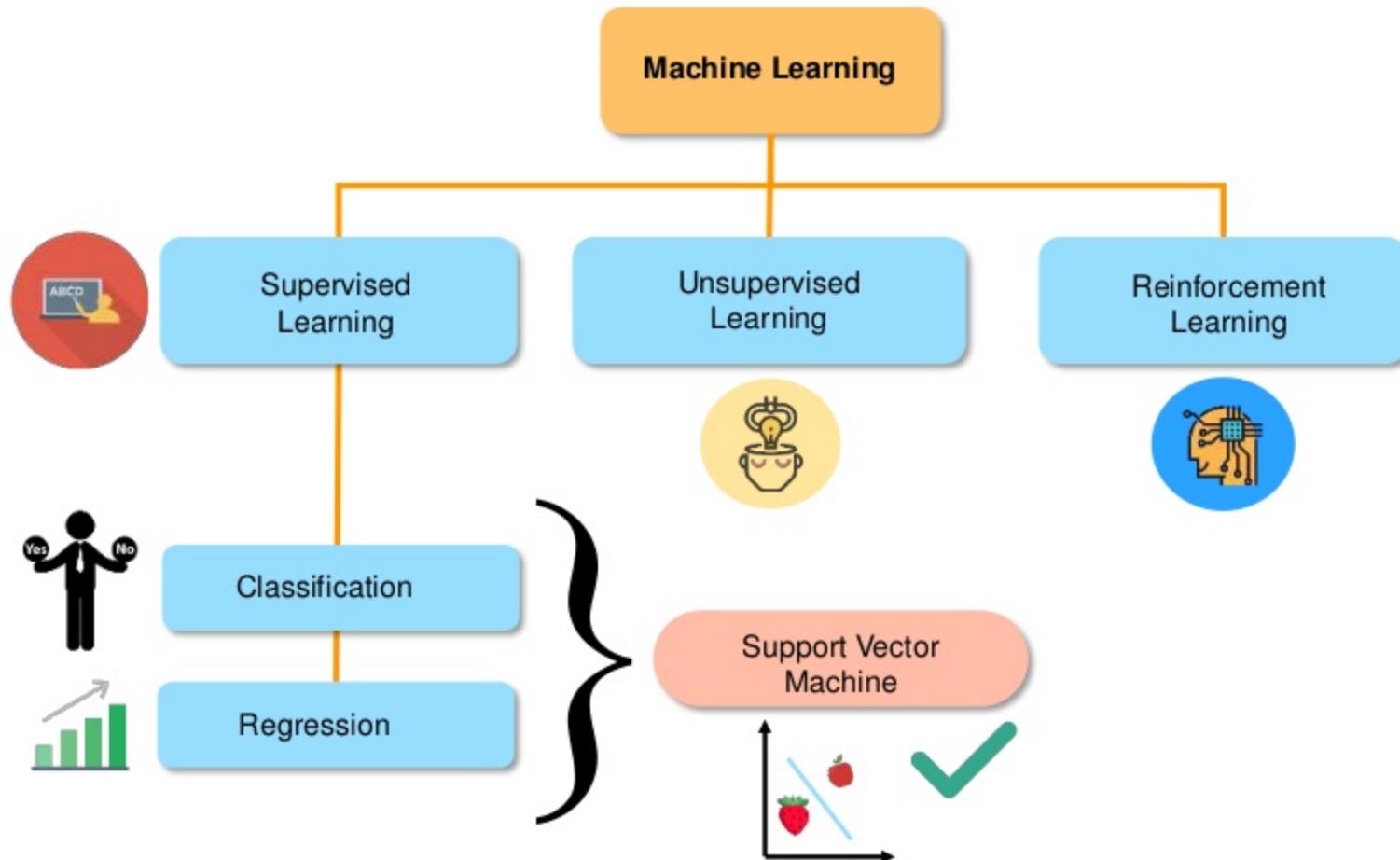


Supervised Learning

Machine learning model learns from the past input data and makes future prediction as output



What is Machine learning?



Why Support Vector Machine?

Last week, my son and I visited a fruit shop



Why Support Vector Machine?

There he found a fruit which was similar to both

Dad, is that an apple or a strawberry?



Why Support Vector Machine?

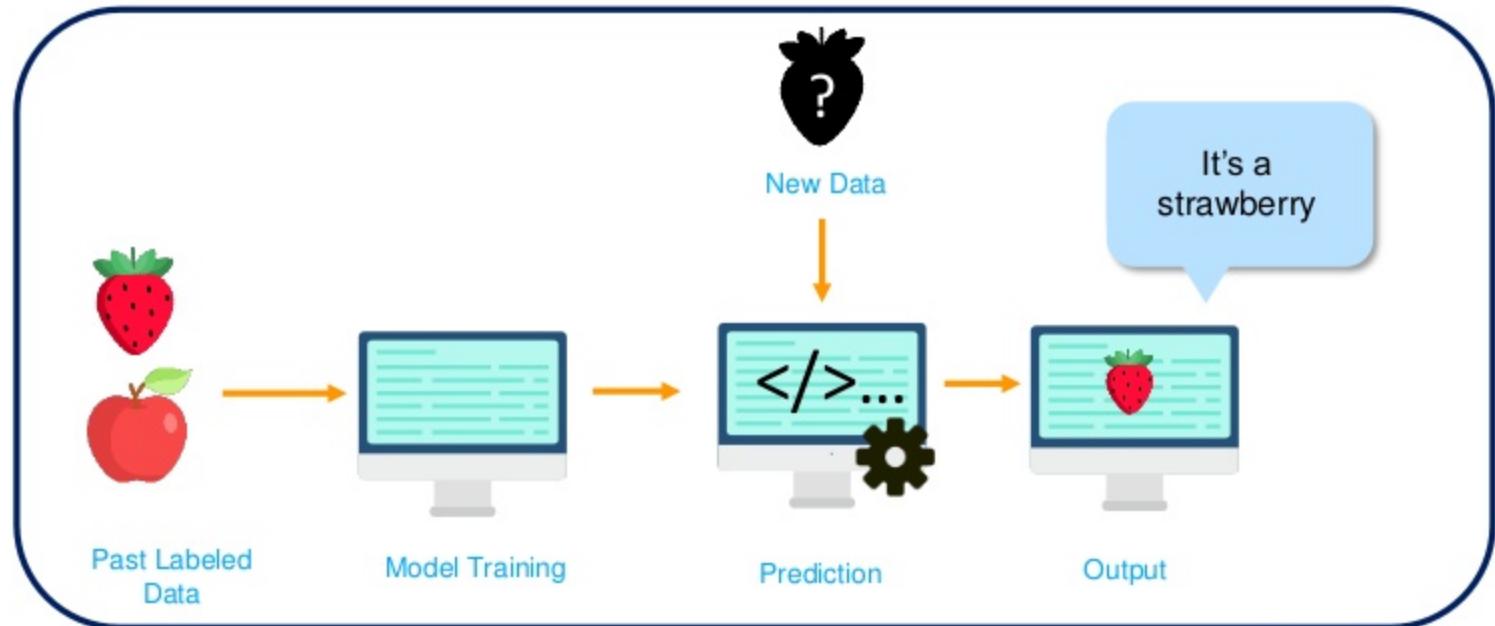
After a couple of seconds,
he could figure out that it
was a strawberry

It is a strawberry!



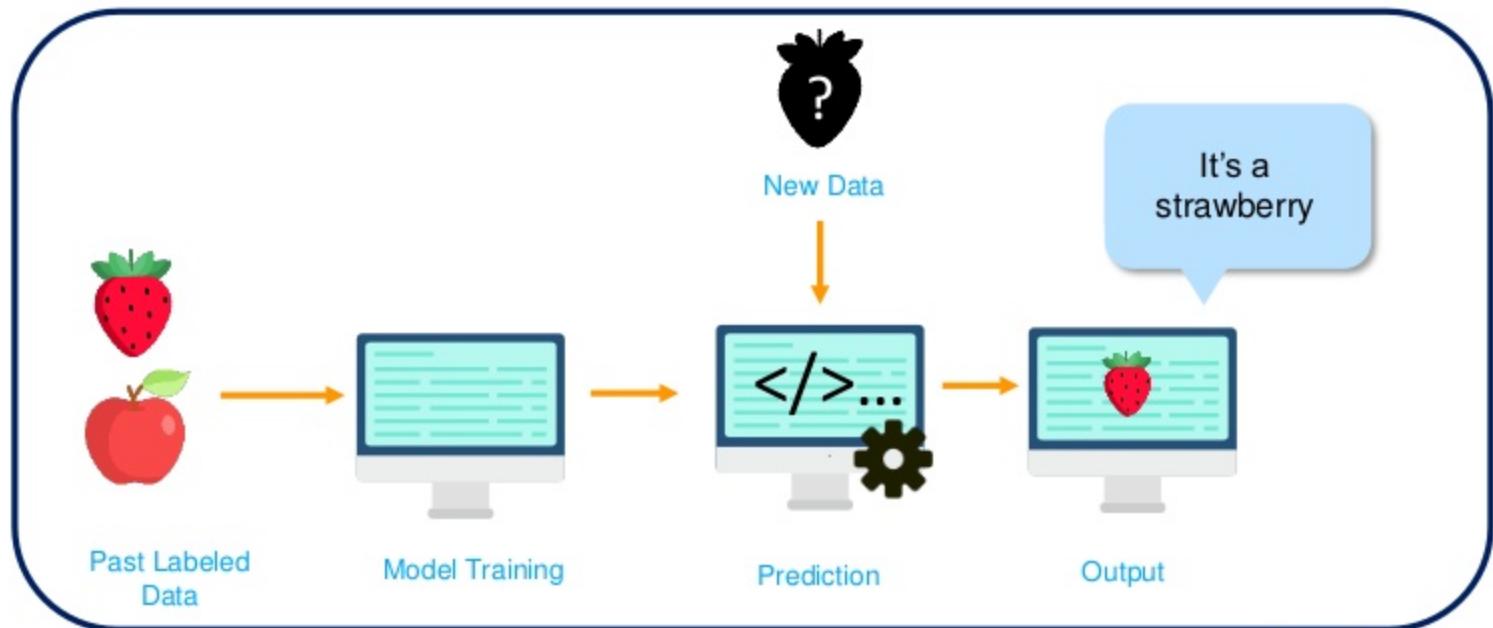
Why Support Vector Machine?

Why not build a model which can predict an unknown data??



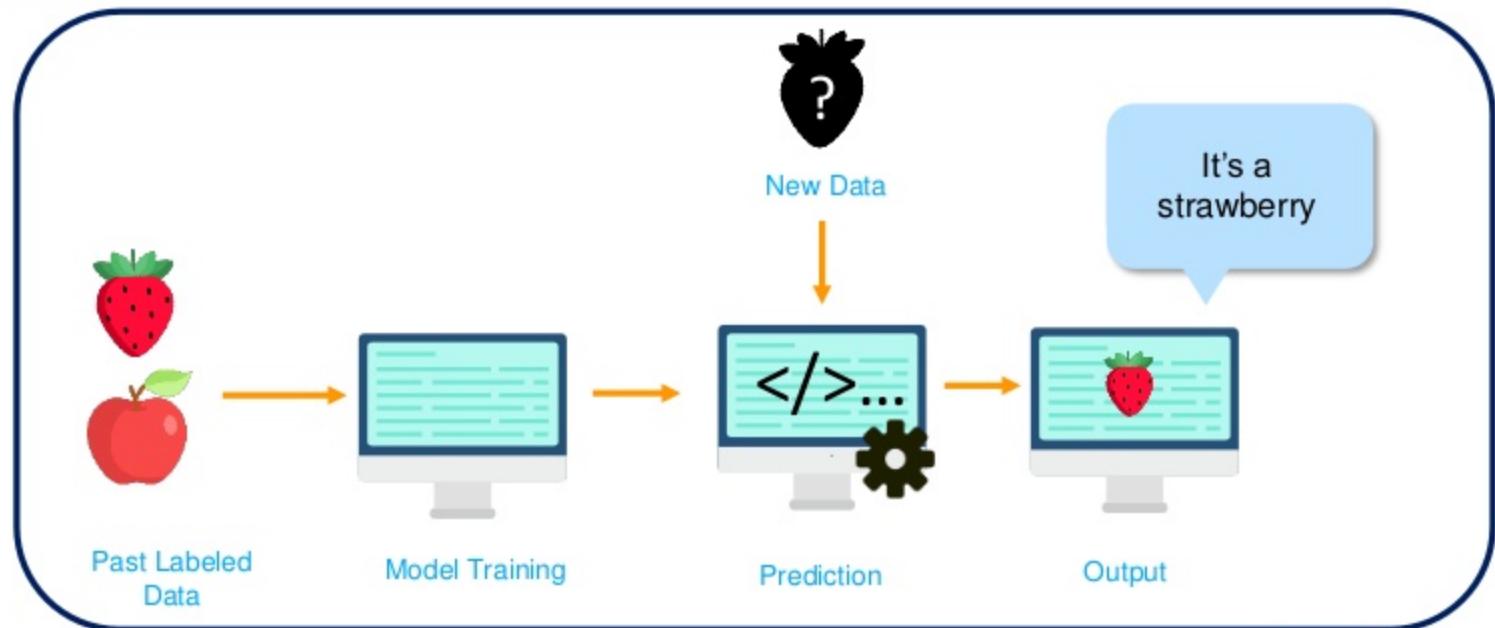
Why Support Vector Machine?

This is Support Vector Machine



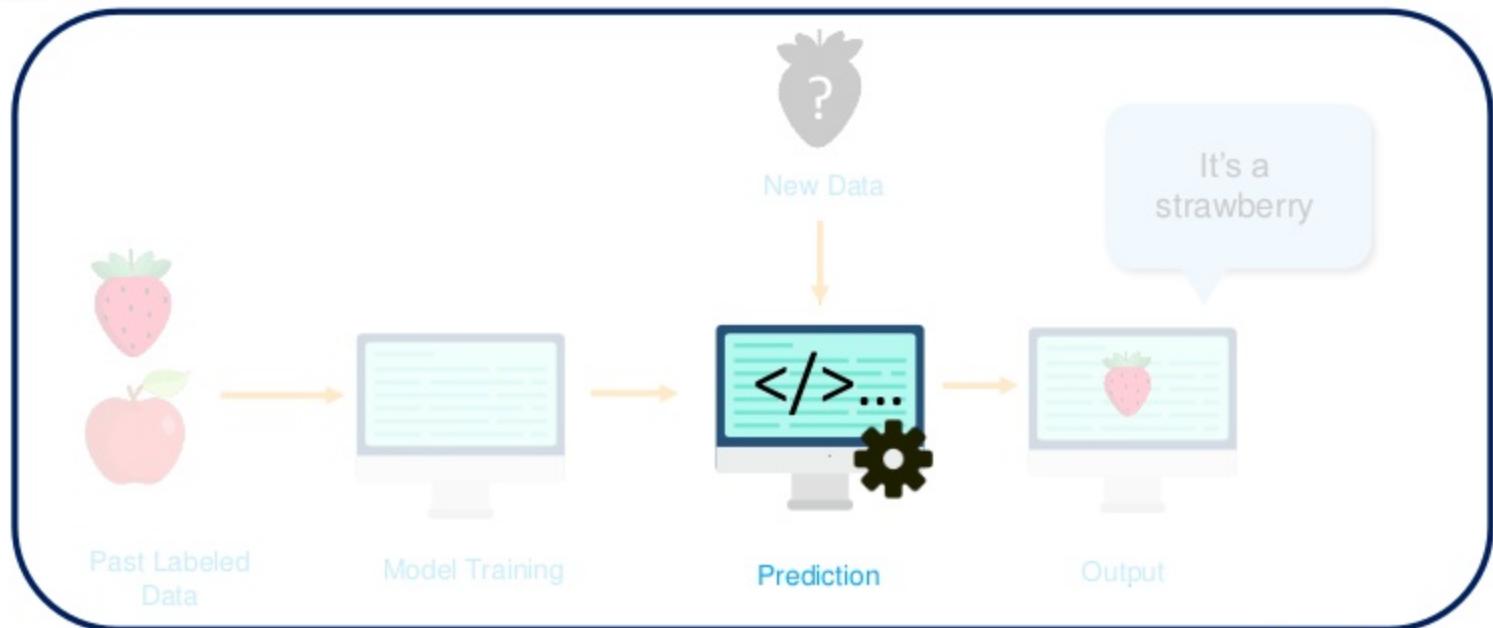
Why Support Vector Machine?

SVM is a supervised learning method that looks at data and sorts it into one of the two categories

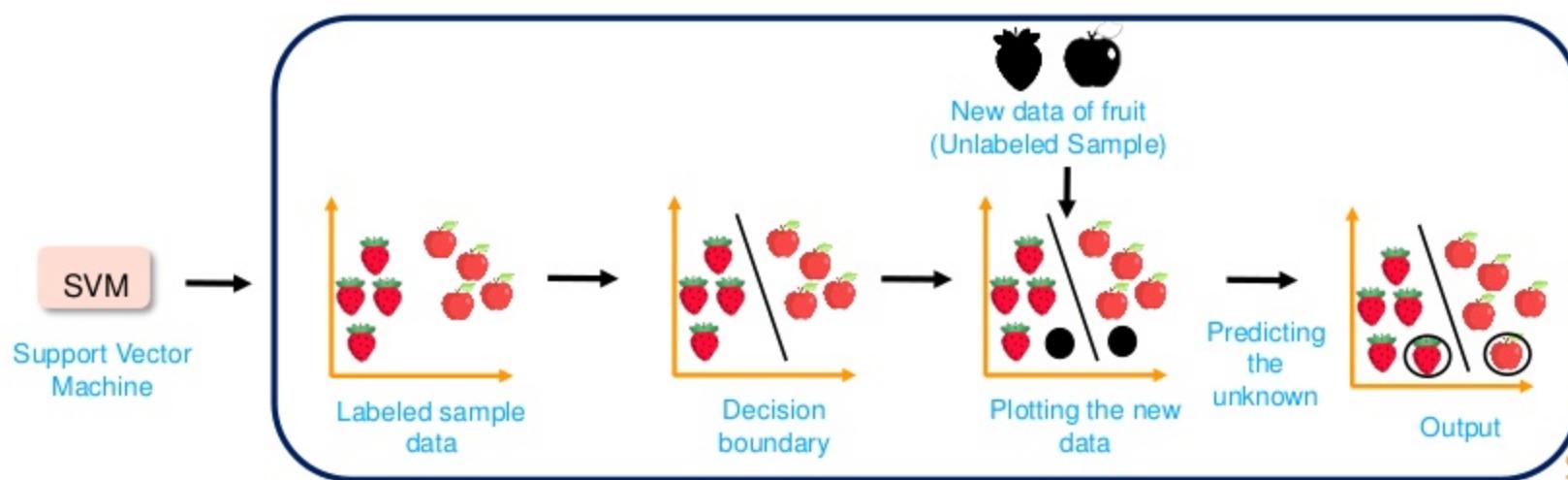


Why Support Vector Machine?

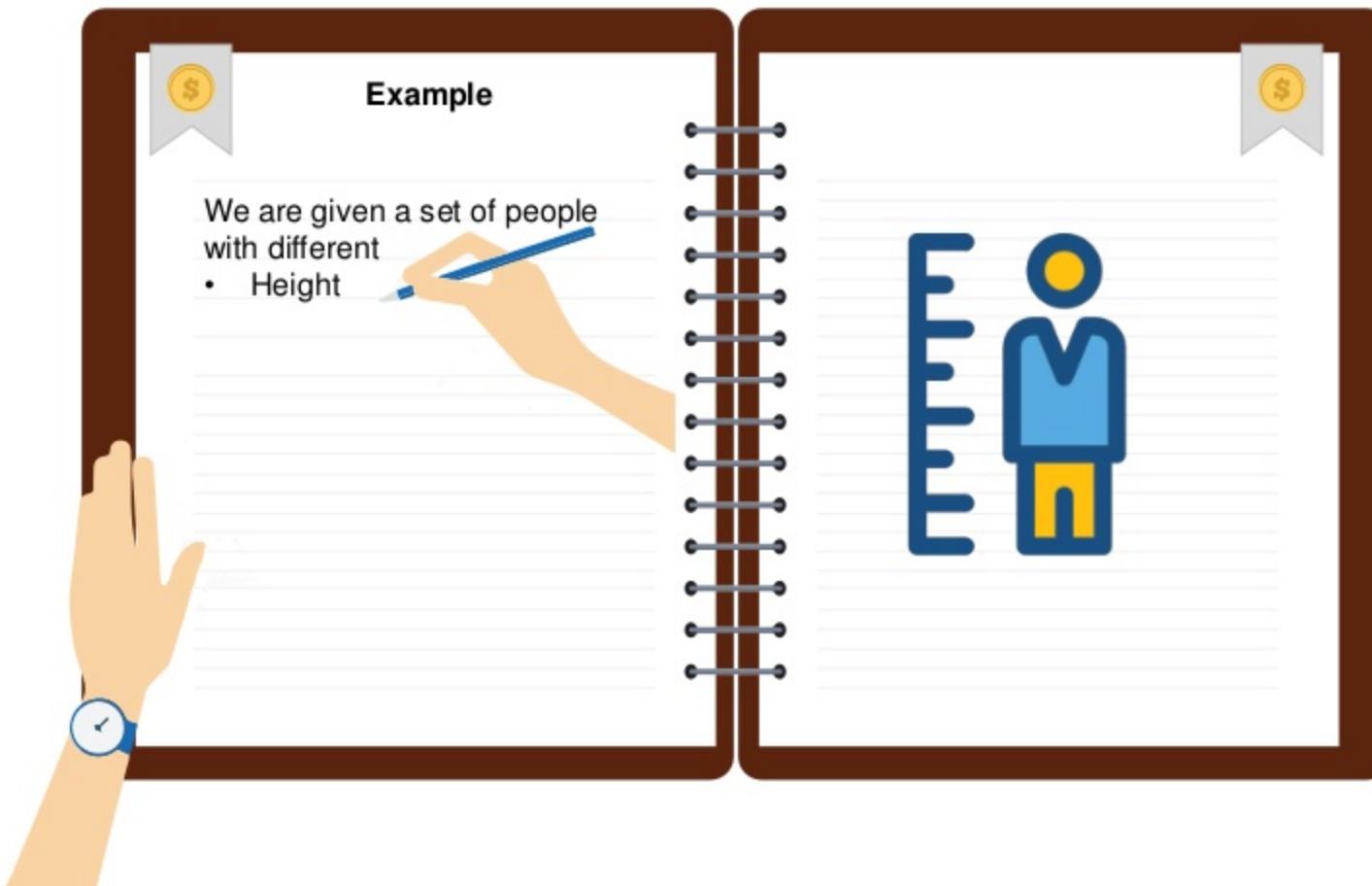
But how does prediction work?



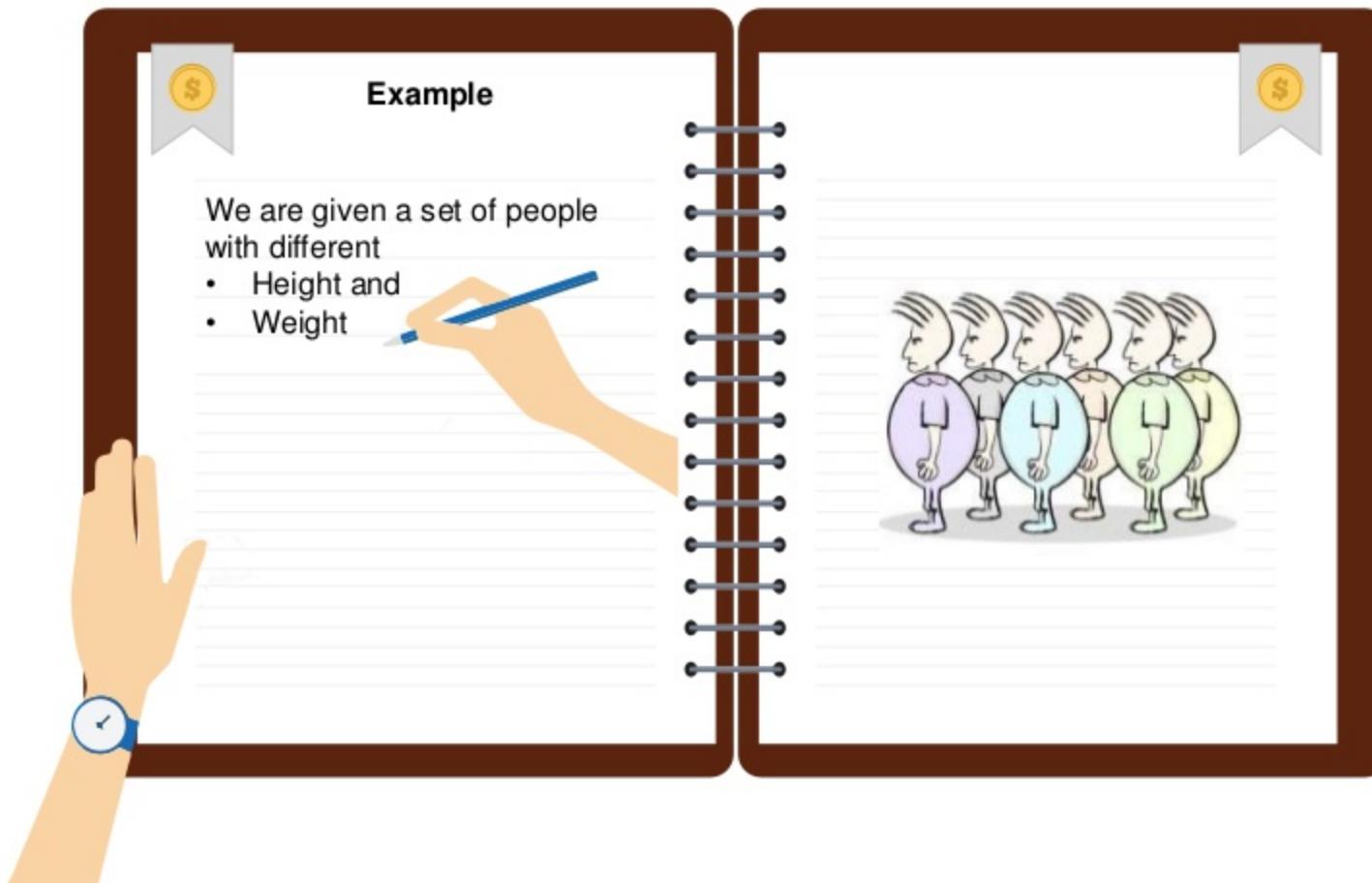
Why Support Vector Machine?



What is Support Vector Machine?



What is Support Vector Machine?



What is Support Vector Machine?

The illustration depicts a brown spiral-bound notebook. On the left page, titled "Example", there is a small gold coin icon at the top. Below it, the text reads: "We are given a set of people with different". A bulleted list follows: "• Height and" and "• Weight". An orange hand is shown writing on the page with a blue pen. On the right page, titled "Sample data set", there is also a small gold coin icon. Below it, the text "Female" is written. A table is provided with two columns: "Height" and "Weight". The data entries are:

Height	Weight
174	65
174	88
175	75
180	65
185	80

simplilearn

What is Support Vector Machine?

The illustration depicts an open notebook with two pages. The left page, titled 'Example', contains text and a hand writing on it. The right page, titled 'Sample data set', contains a table of data.

Example

We are given a set of people with different

- Height and
- Weight

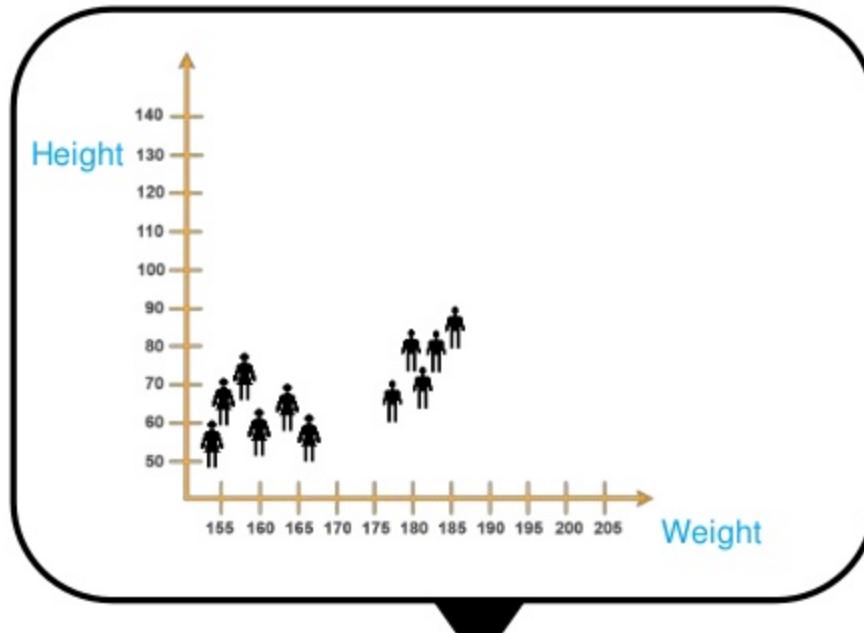
A hand is shown writing on the page.

Sample data set

Male

Height	Weight
179	90
180	80
183	80
187	85
182	72

What is Support Vector Machine?



Let's add a new data point and figure out if it's a male or a female?



What is Support Vector Machine?

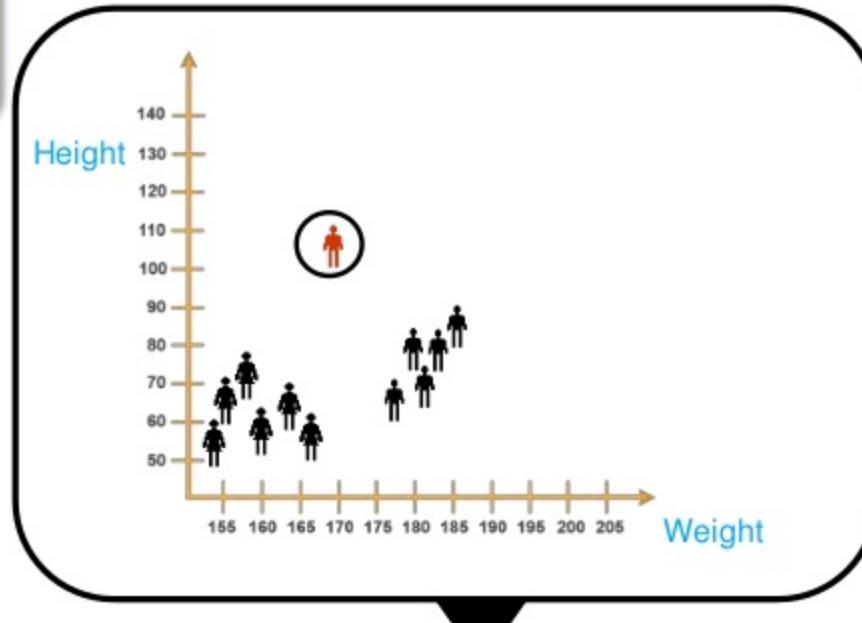


Let's add a new data point and figure out if it's a male or a female?



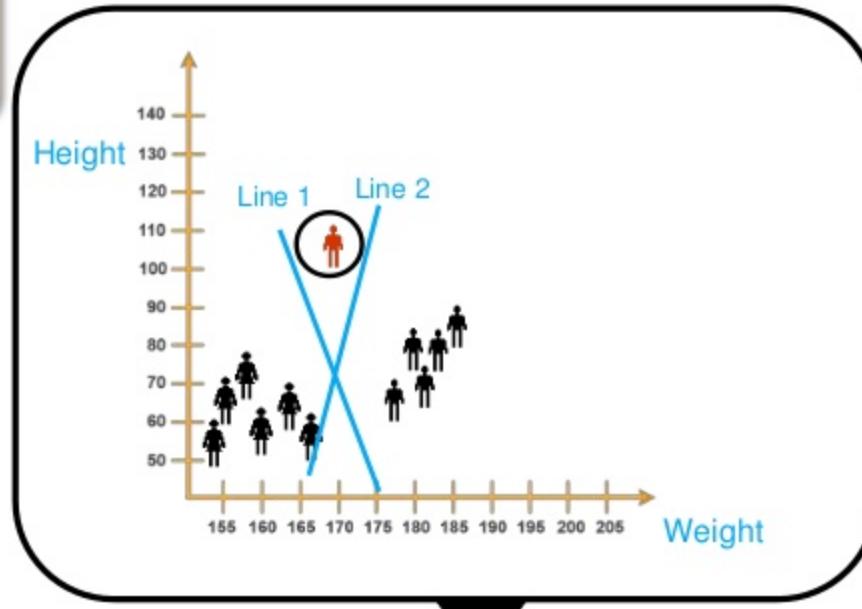
What is Support Vector Machine?

Sure.. For this task, we need to split our data first



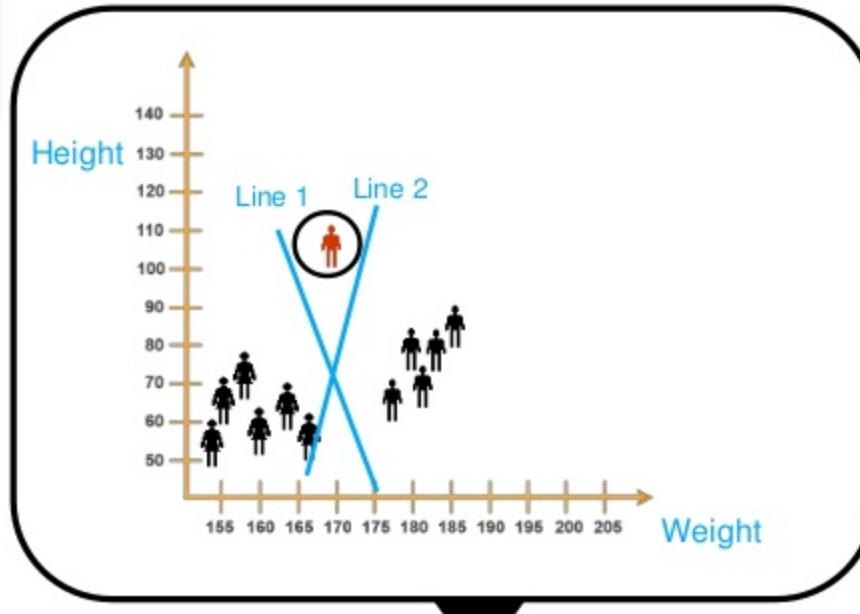
What is Support Vector Machine?

We can split our data by choosing any of these lines



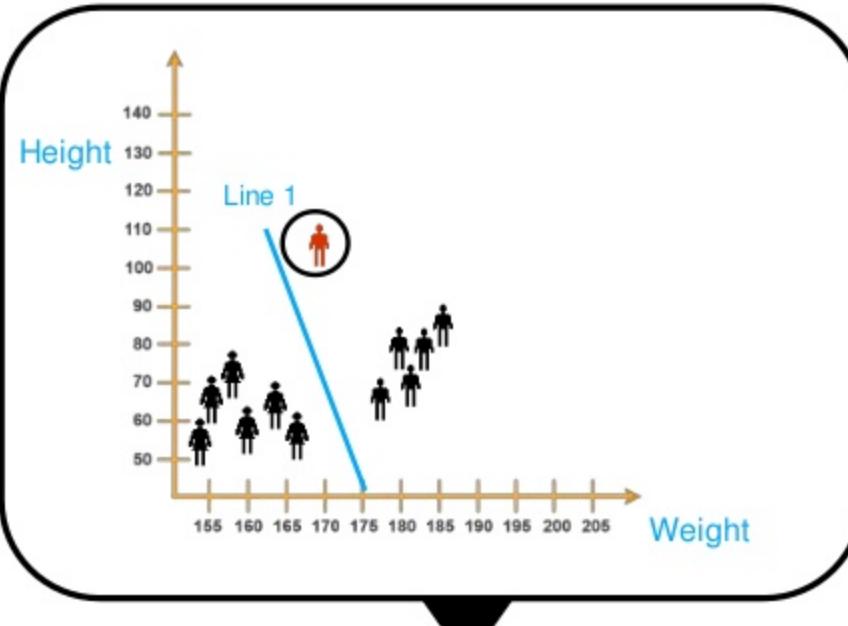
What is Support Vector Machine?

But to predict the gender of a new data point we should split the data in the best possible way



What is Support Vector Machine?

Then I would say, this line best splits the data

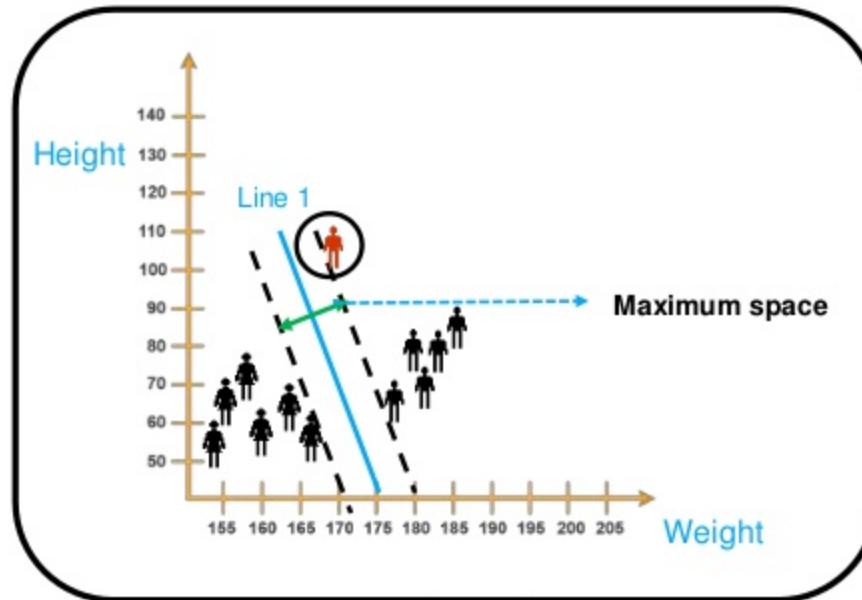


Why do you say it's the best split??



What is Support Vector Machine?

This line has the maximum space that separates the two classes

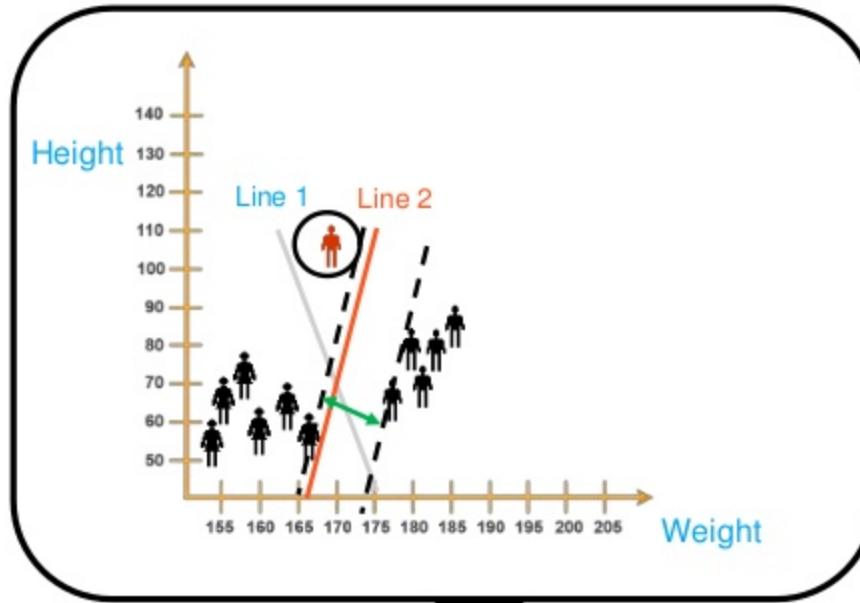


Why do you say it's the best split??



What is Support Vector Machine?

While the other line doesn't have the maximum space that separates the two classes

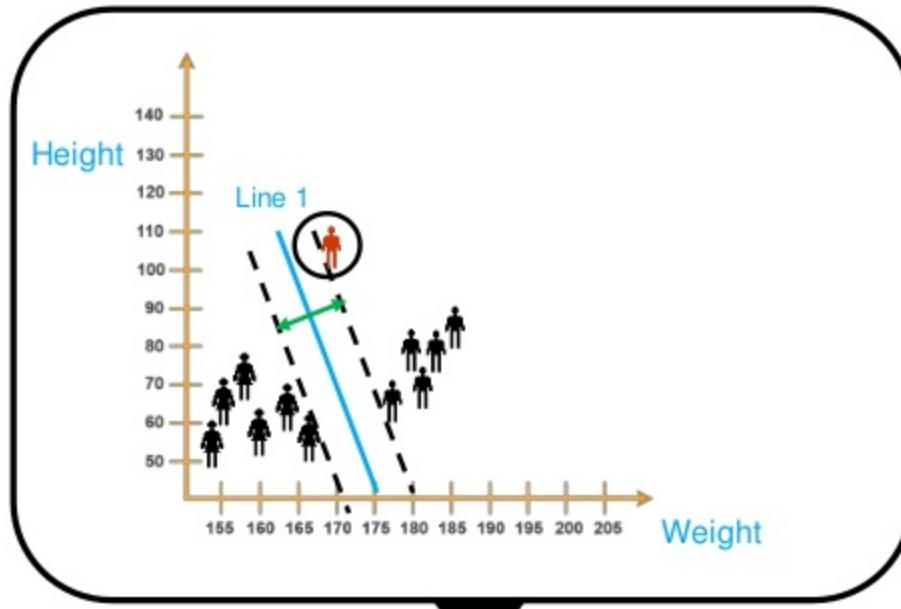


Why do you say it's the best split??



What is Support Vector Machine?

That is why this line best splits the data

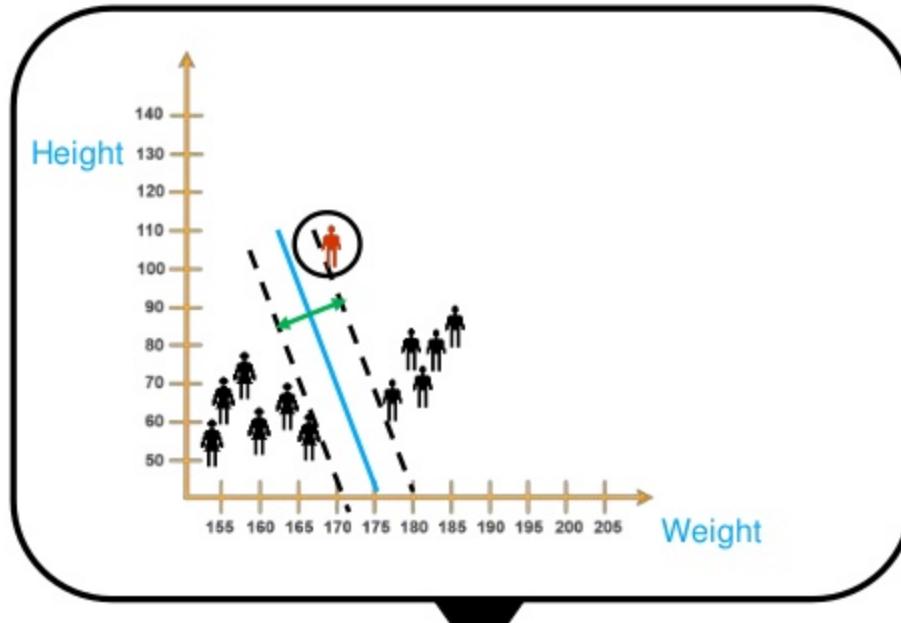


Well yes.. This is the best split!



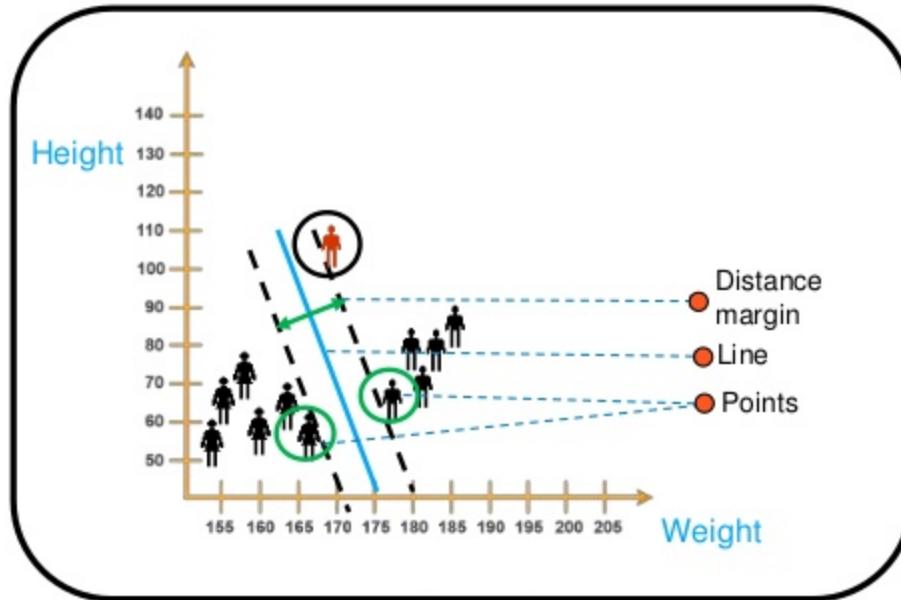
What is Support Vector Machine?

Now, Let me add some technical terms to this



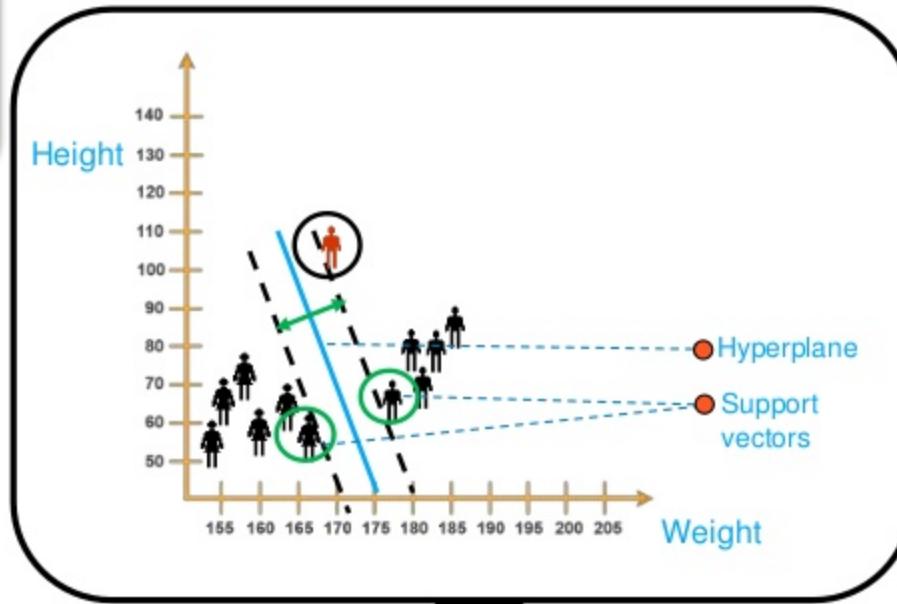
What is Support Vector Machine?

We can also say that the distance between the points and the line should be far as possible



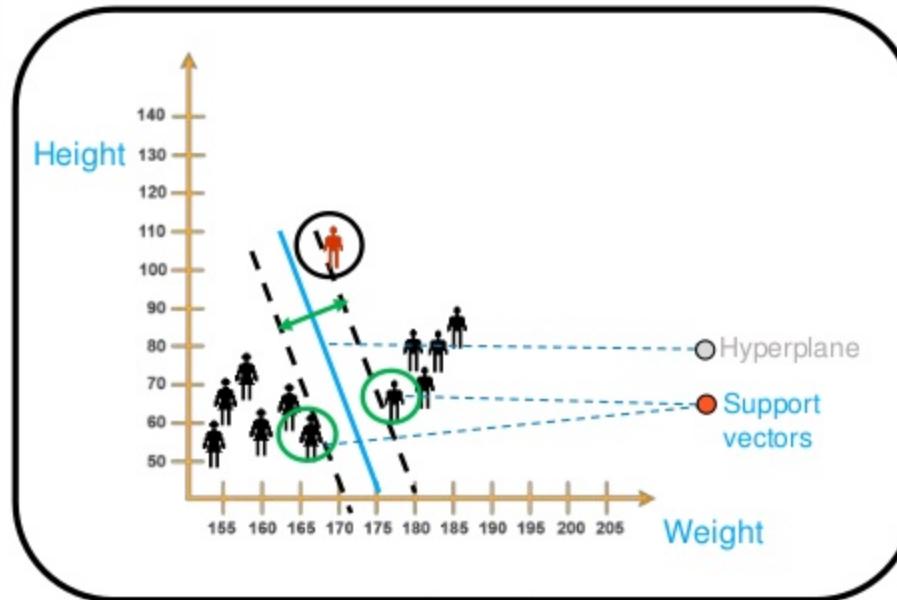
What is Support Vector Machine?

In technical terms we can say,
the distance between the
support vector and the
hyperplane should be far as
possible



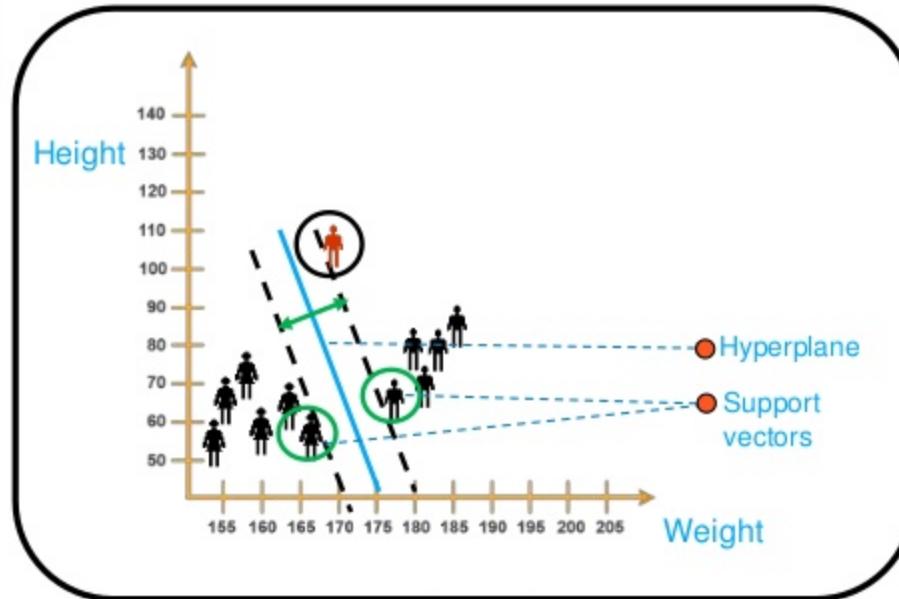
What is Support Vector Machine?

Where support vectors are the extreme points in the datasets



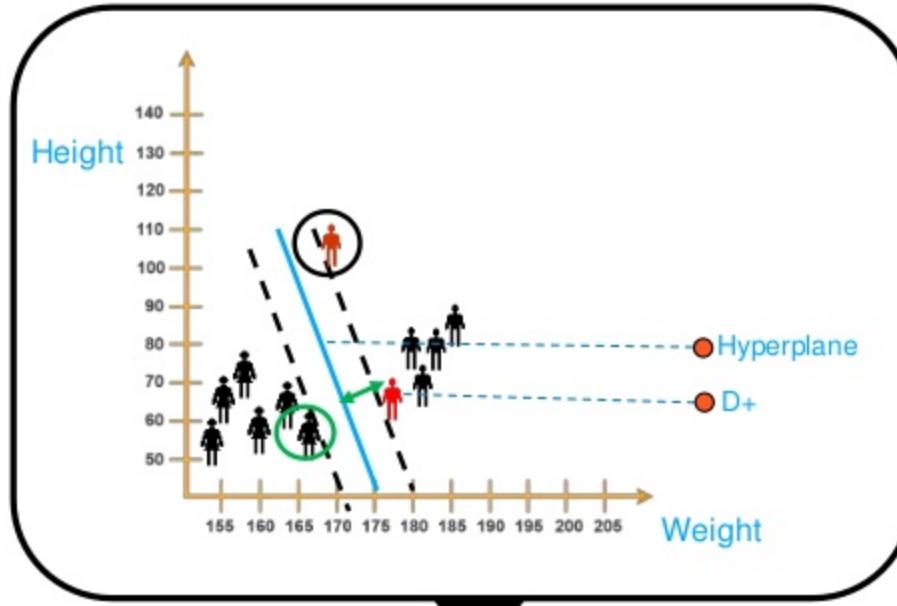
What is Support Vector Machine?

And a hyperplane has the maximum distance to the support vectors of any class



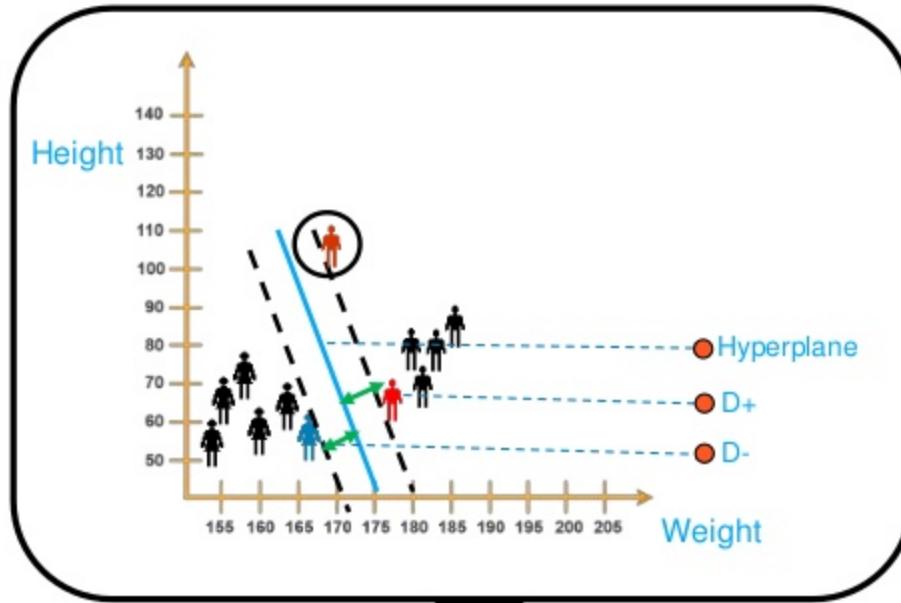
What is Support Vector Machine?

Here, D+ is the shortest distance to the closest positive point



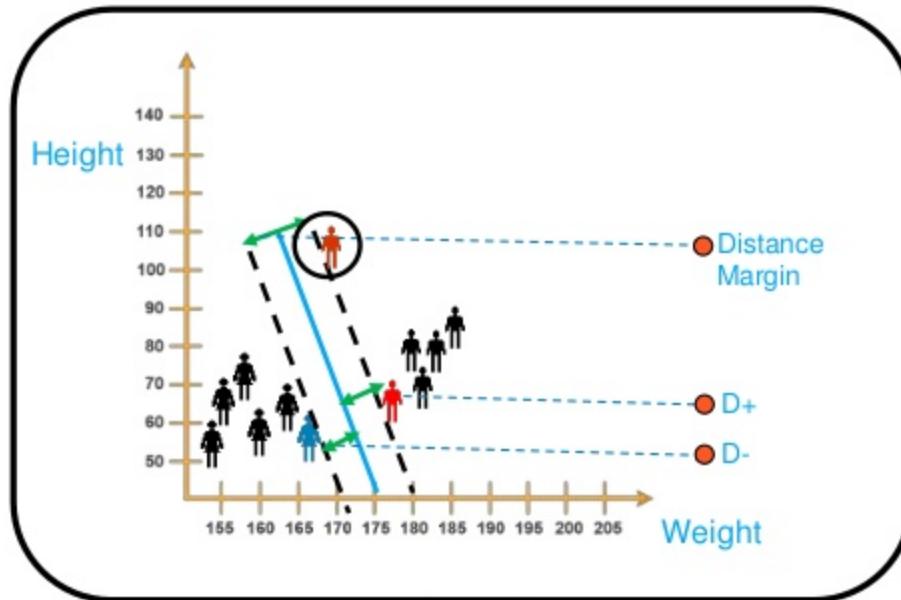
What is Support Vector Machine?

And D- is the shortest distance to the closest negative point



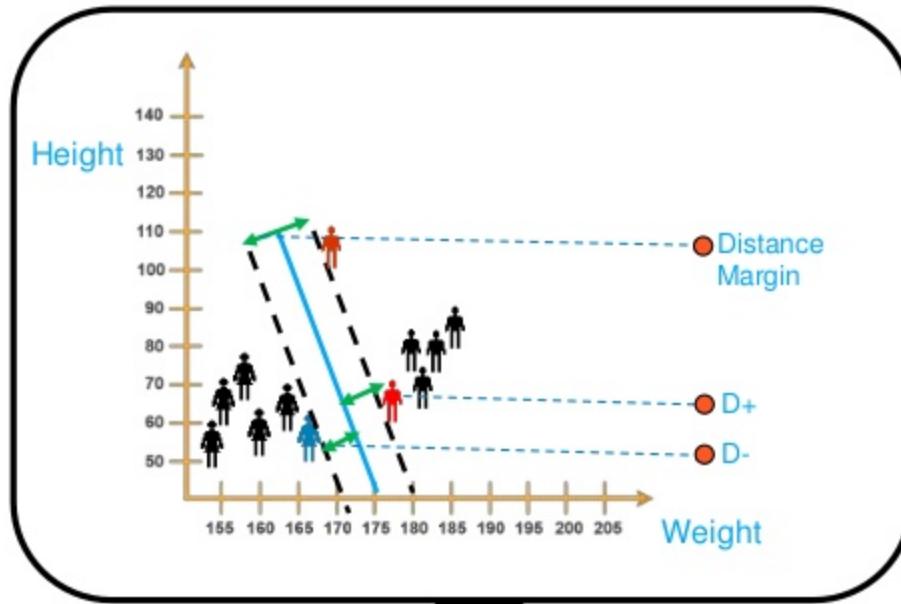
What is Support Vector Machine?

Sum of D+ and D- is called the distance margin



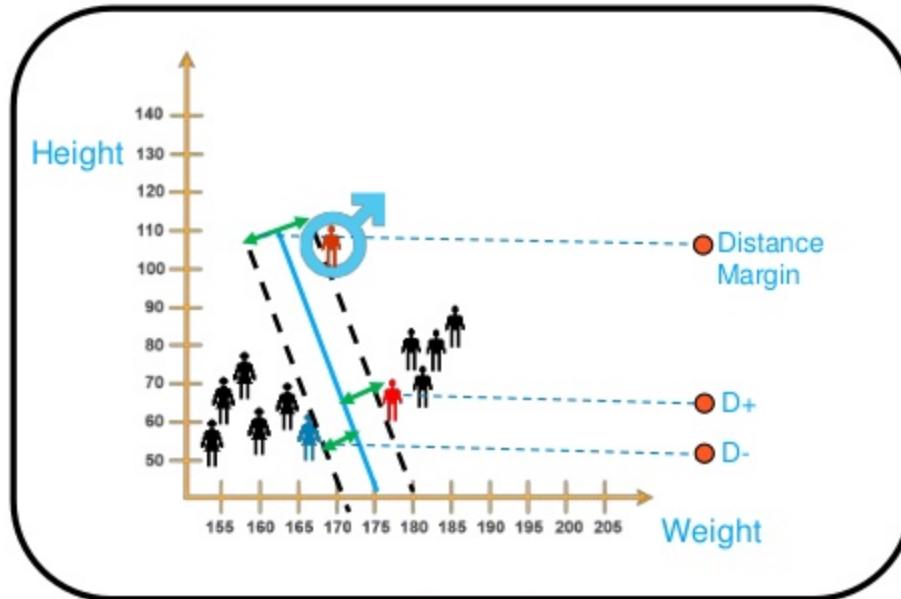
What is Support Vector Machine?

From the distance margin, we get an optimal hyperplane



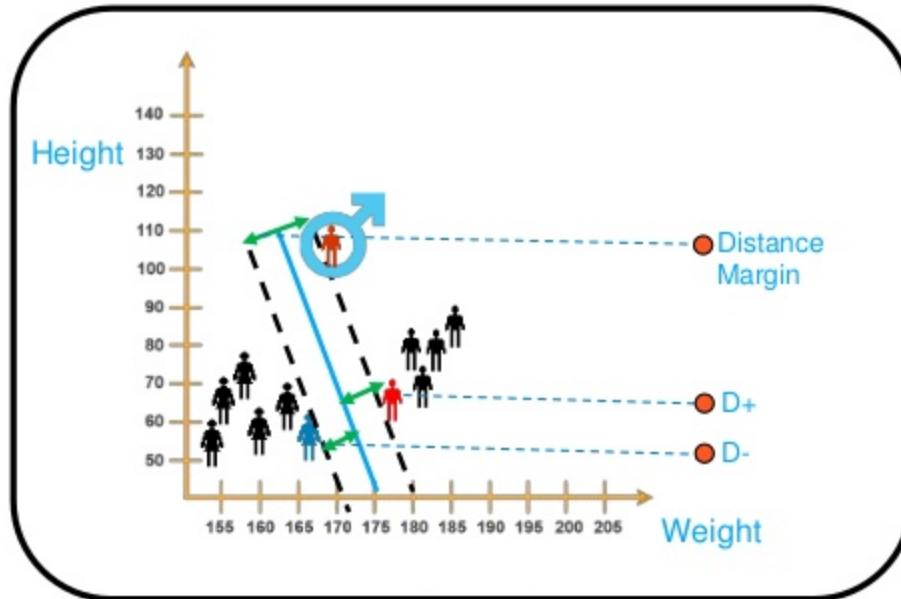
What is Support Vector Machine?

Based on the hyperplane,
we can say the new data point
belongs to male gender



What is Support Vector Machine?

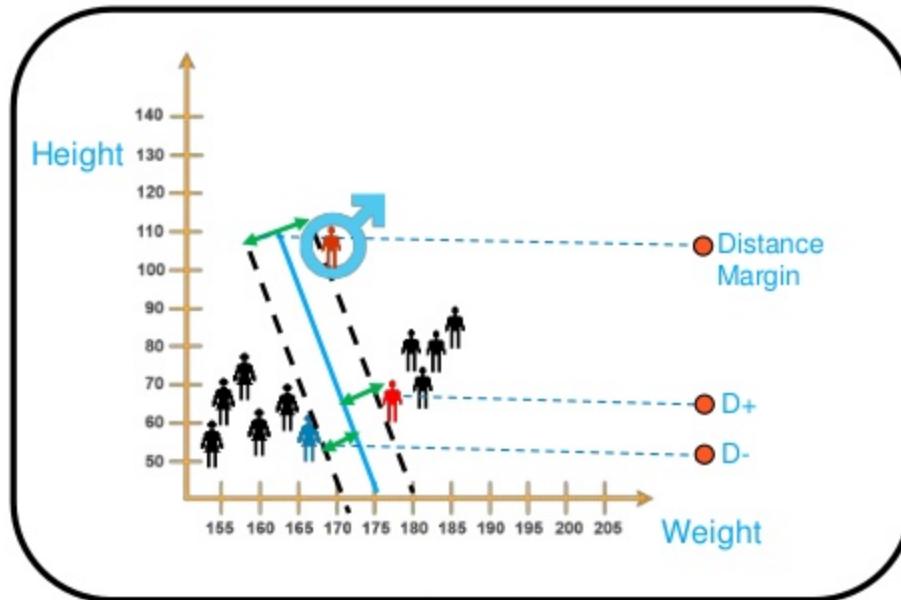
Based on the distance margin,
we can say the new data point
belongs to male gender



That was so clear!



What is Support Vector Machine?

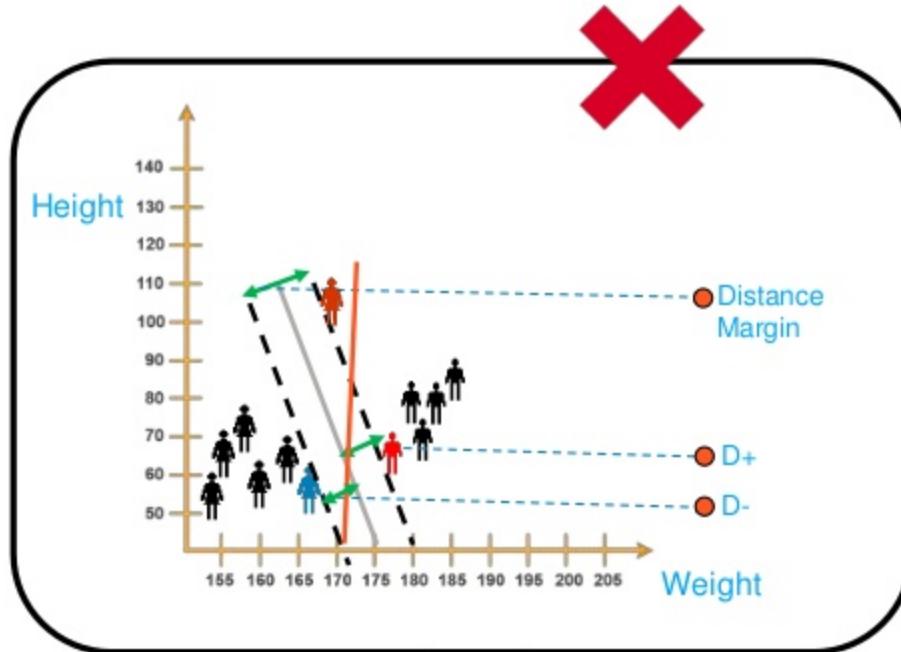


But what happens if a hyperplane is not optimal?



What is Support Vector Machine?

If we select a hyperplane having low margin then there is high chance of misclassification

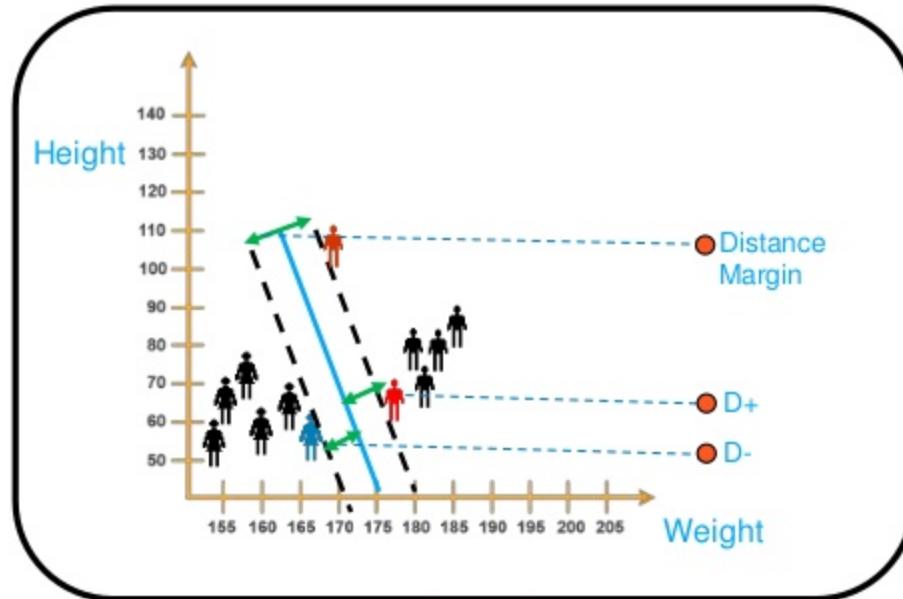


But what happens if a hyperplane is not optimal?



What is Support Vector Machine?

What we discussed so far, is also called as **LSVM**



But what happens if a hyperplane is not optimal?



Understanding Support Vector Machine

Well, so far it is clear



Understanding Support Vector Machine

I have one question to ask
!

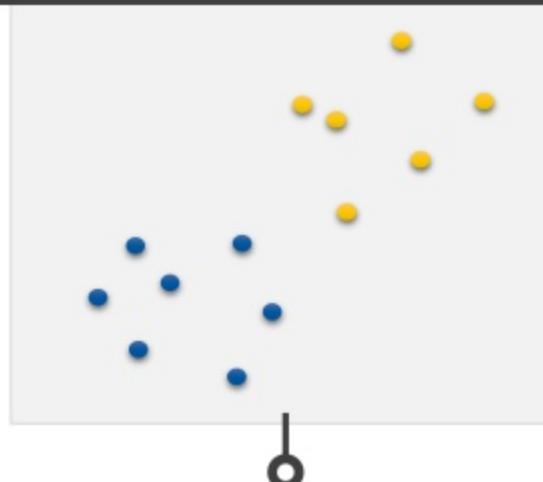


Understanding Support Vector Machine

What if my data was not
like this

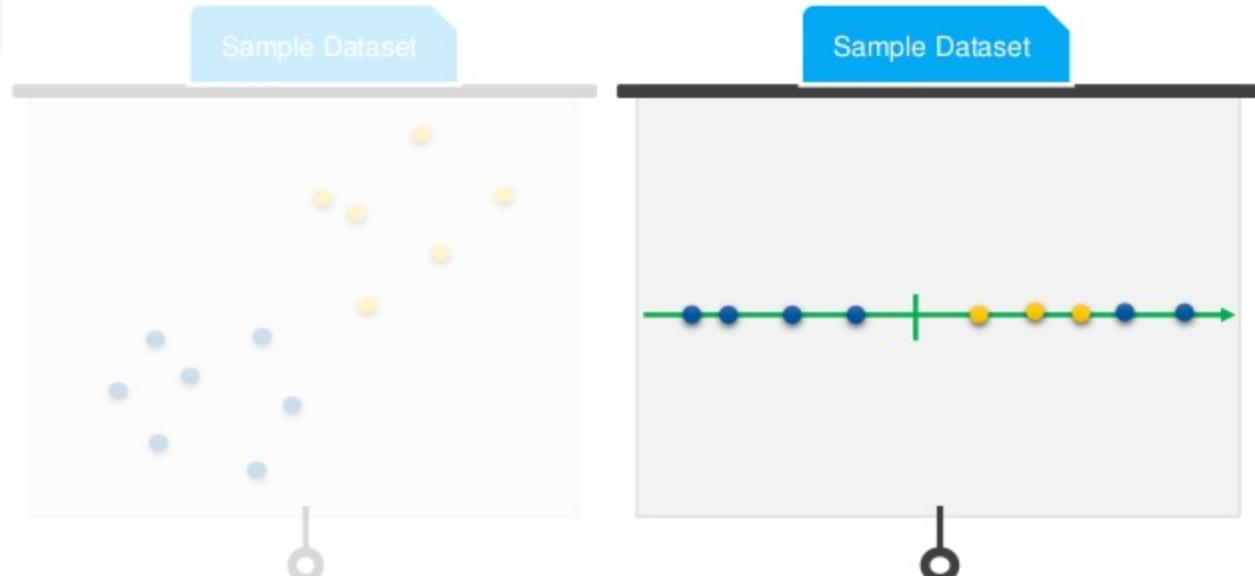


Sample Dataset



Understanding Support Vector Machine

But like this?



Understanding Support Vector Machine

Here, we cannot use a hyperplane

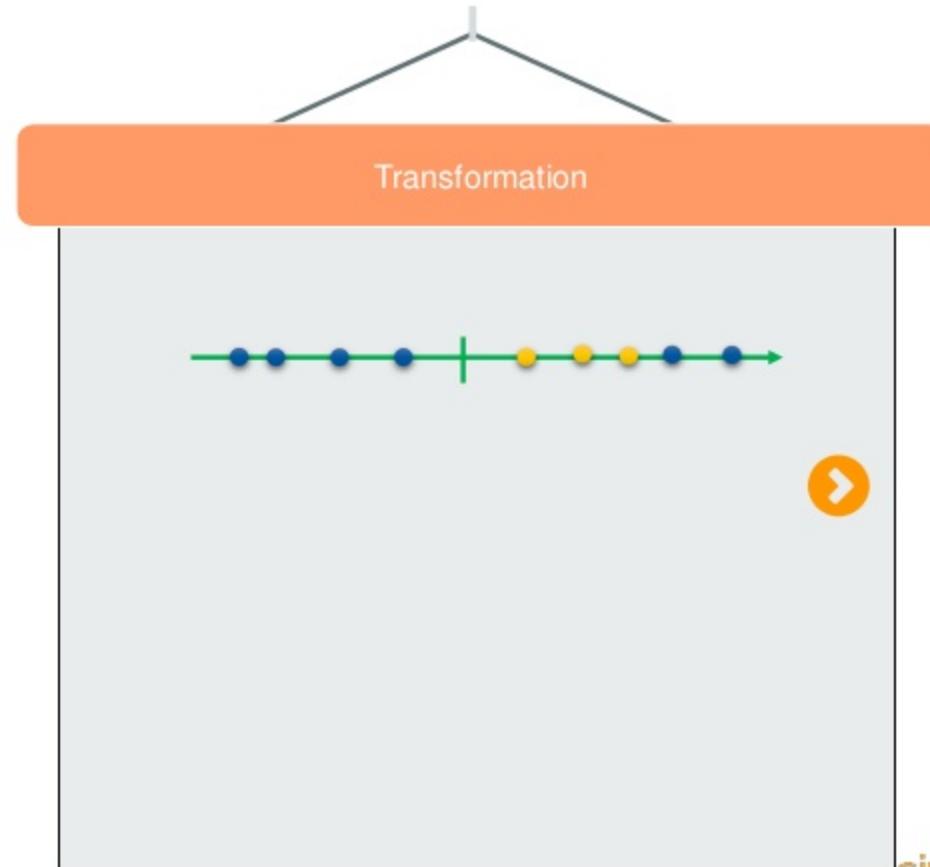


Transformation



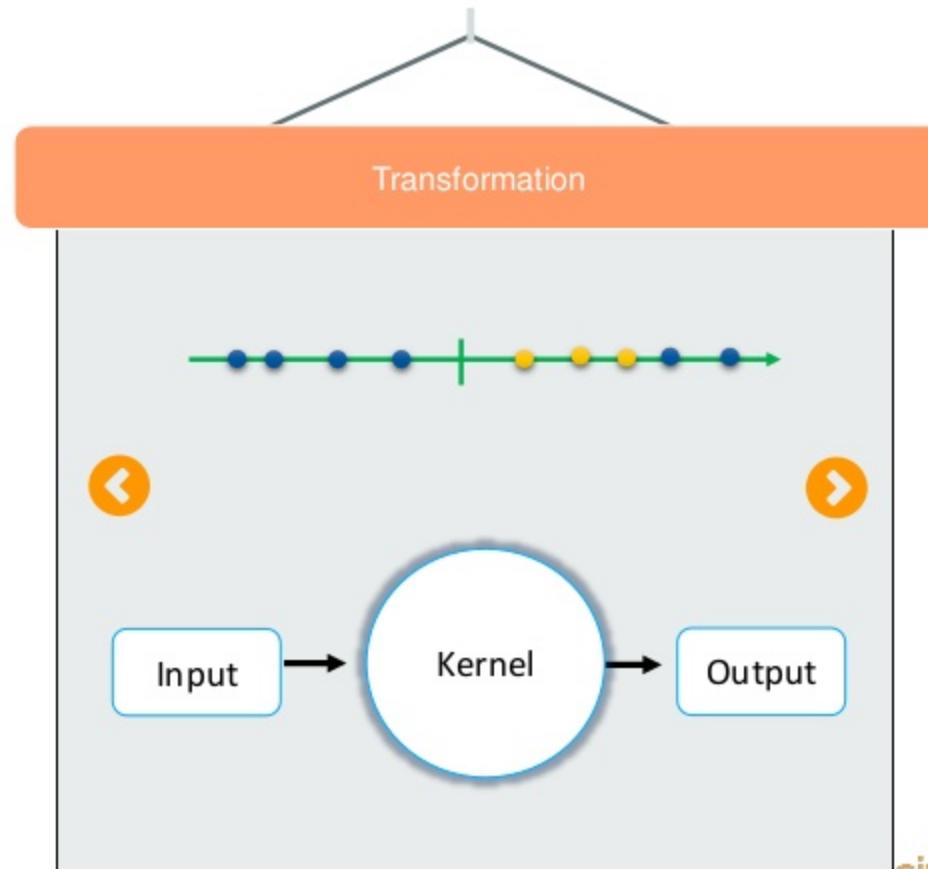
Understanding Support Vector Machine

So, it's necessary to move away from a 1-D view of the data to a 2-D view



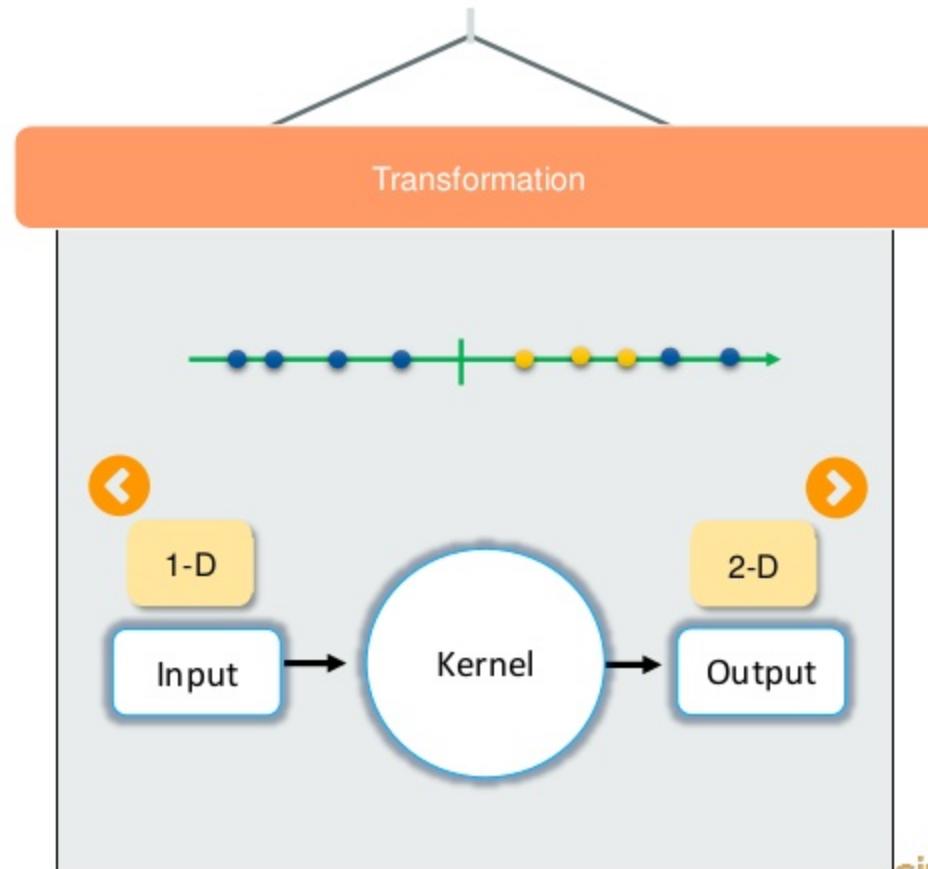
Understanding Support Vector Machine

For the transformation, we use a Kernel Function



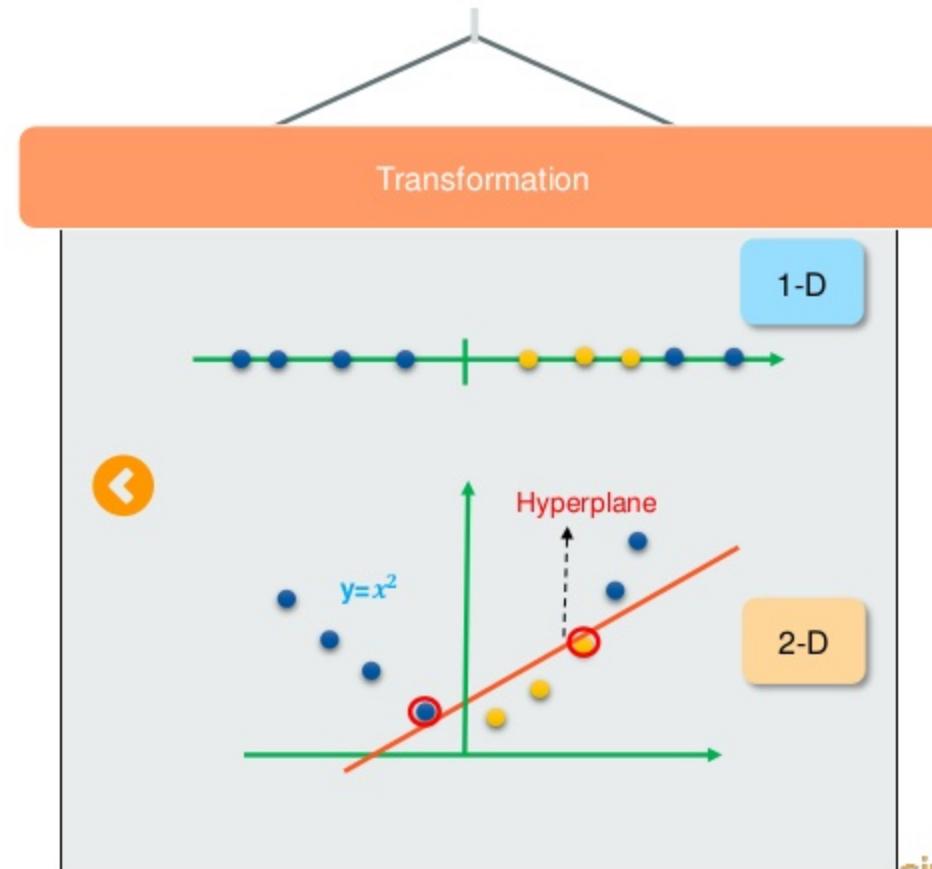
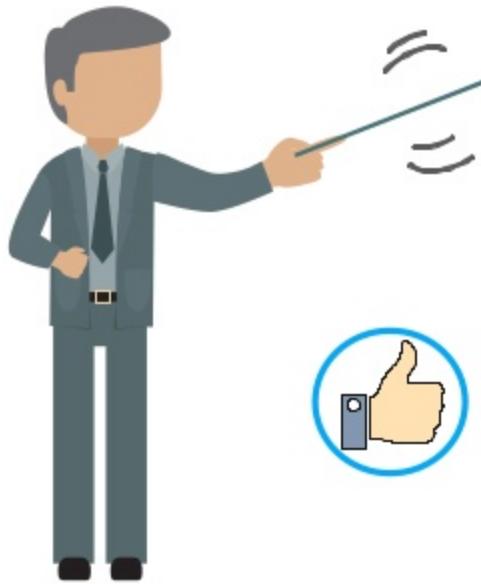
Understanding Support Vector Machine

Which will take the 1-D input and transfer it to 2-D Output



Understanding Support Vector Machine

Now, we got the result !!

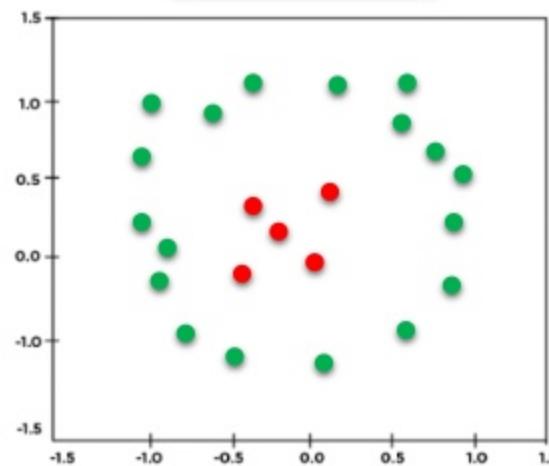


Understanding Support Vector Machine

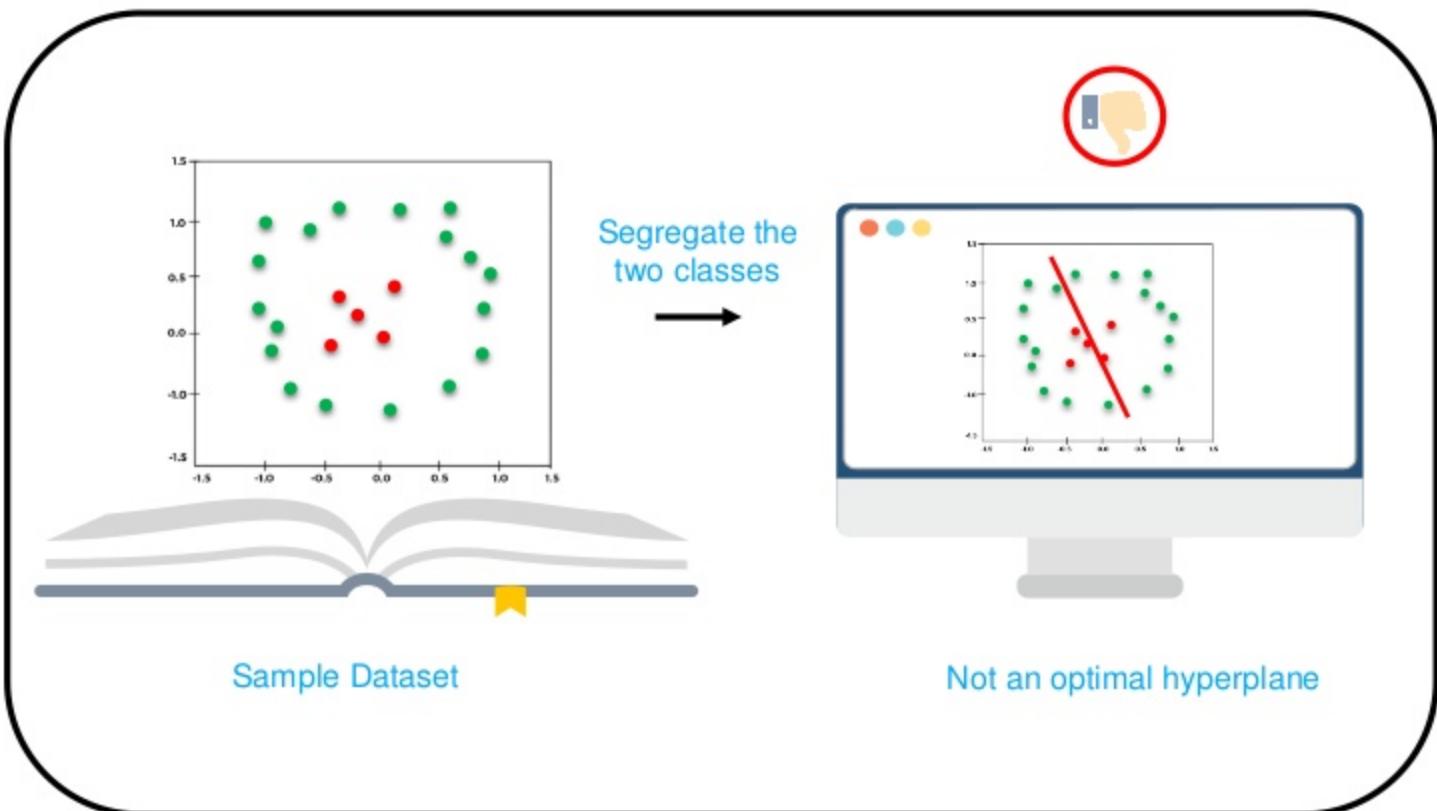
How to perform SVM
for this type of dataset?



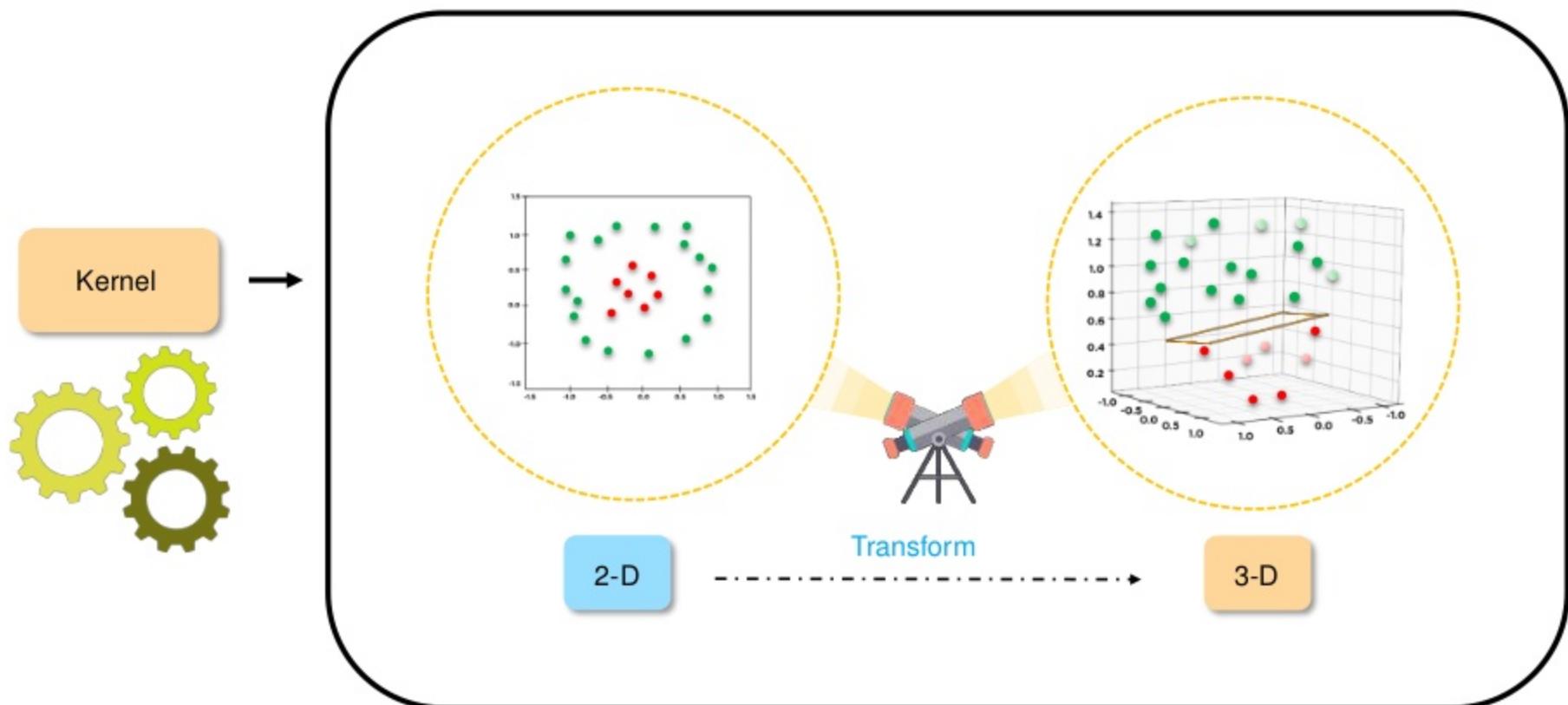
Sample Dataset



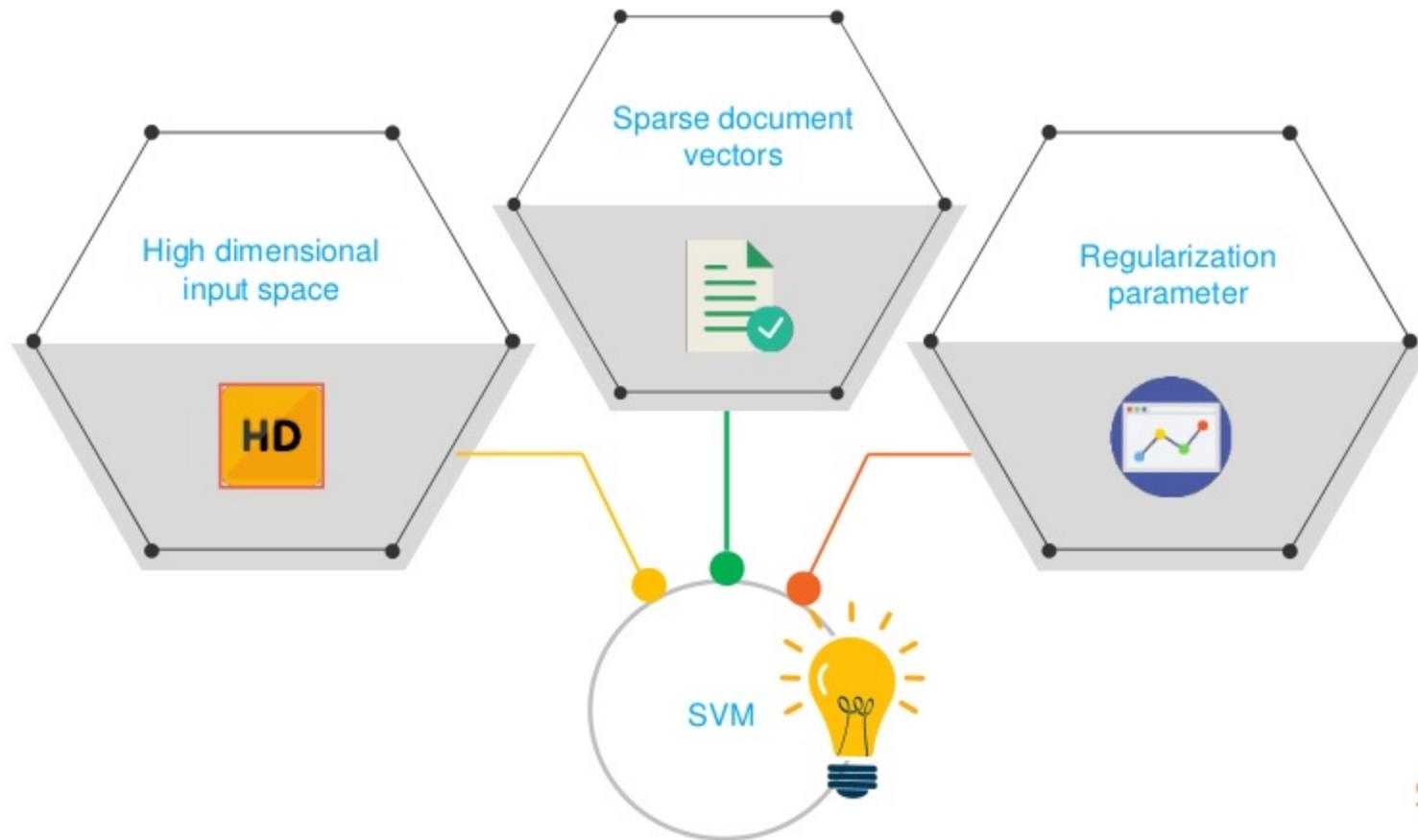
Understanding Support Vector Machine



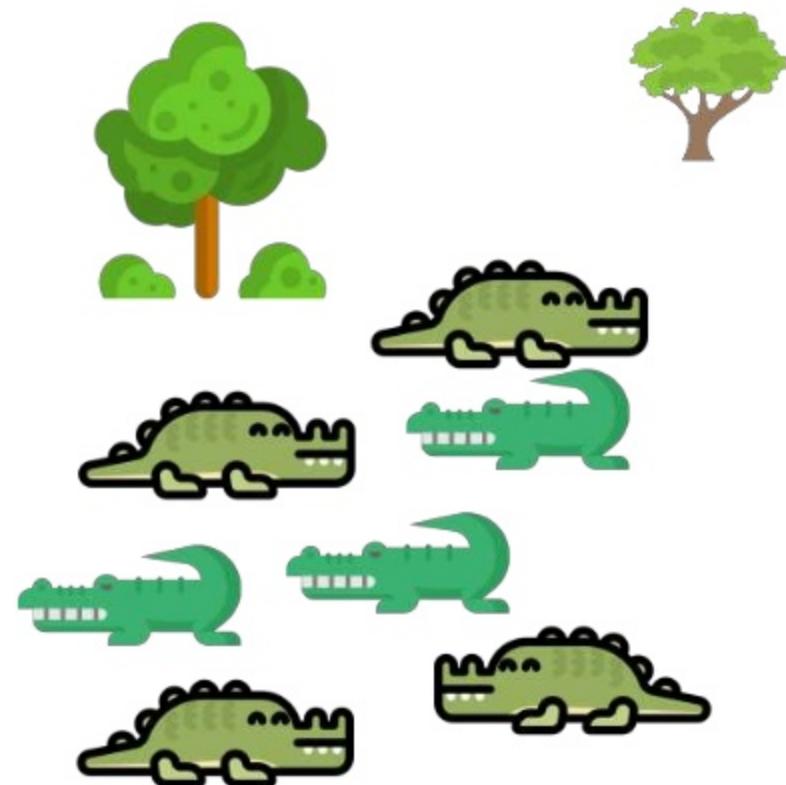
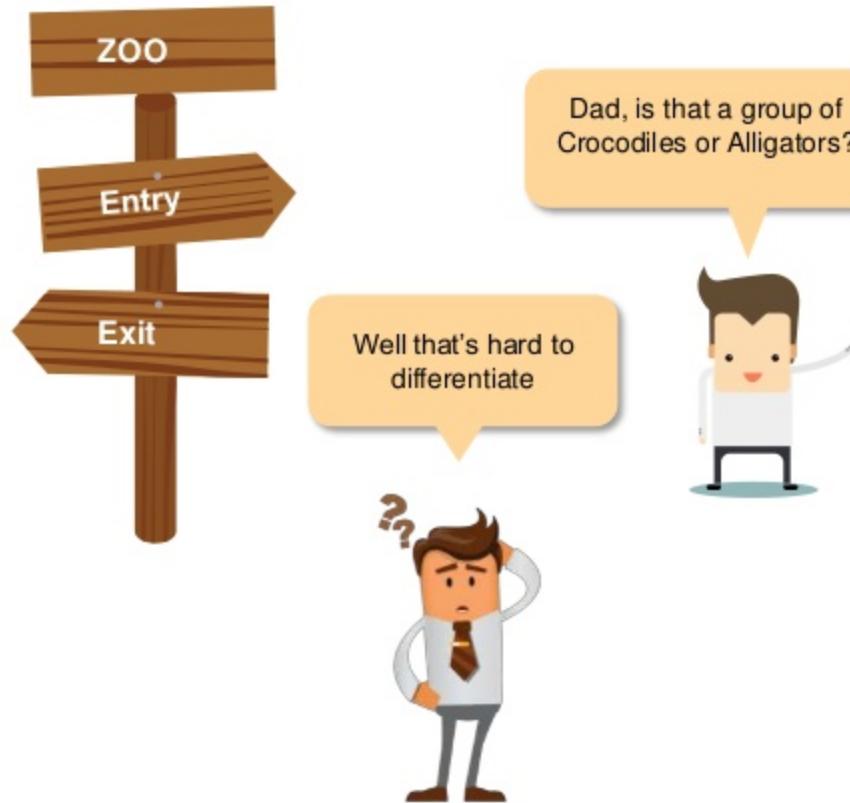
Understanding Support Vector Machine



Advantages of Support Vector Machine



Use case – Problem Statement



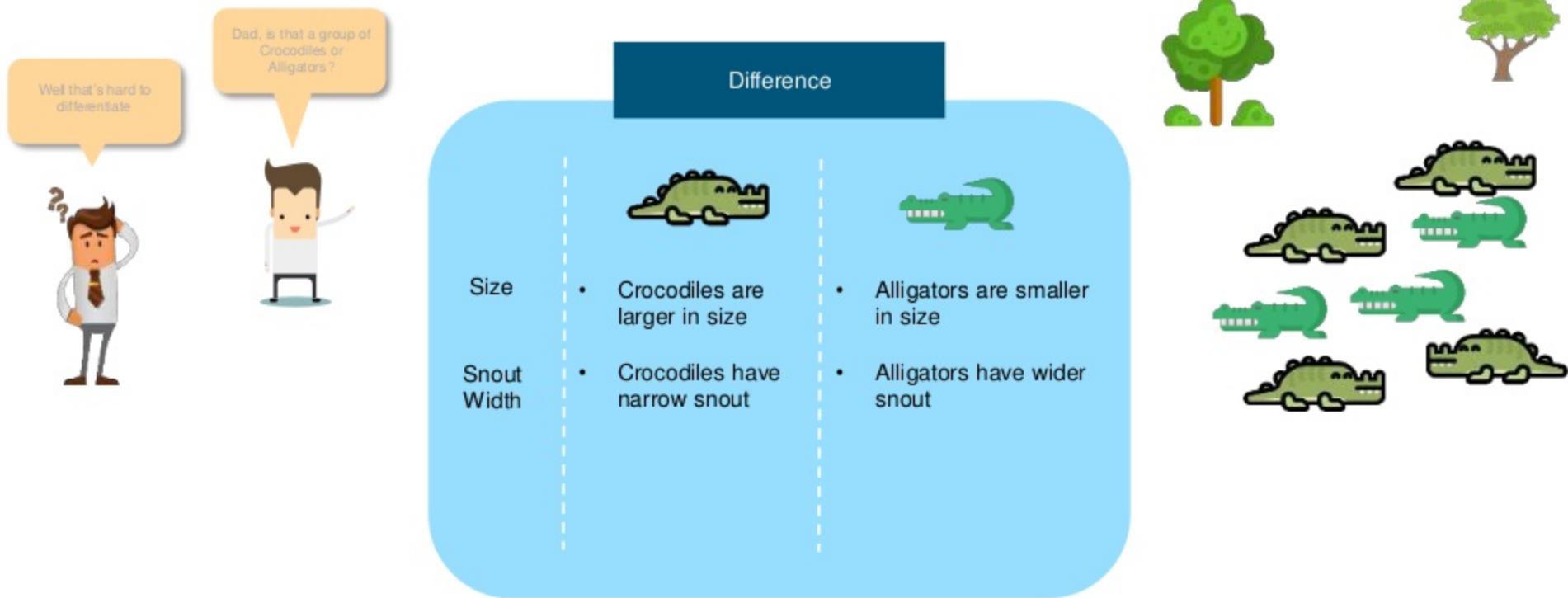
Use case – Problem Statement

Well that's hard to differentiate

Dad, is that a group of Crocodiles or Alligators?

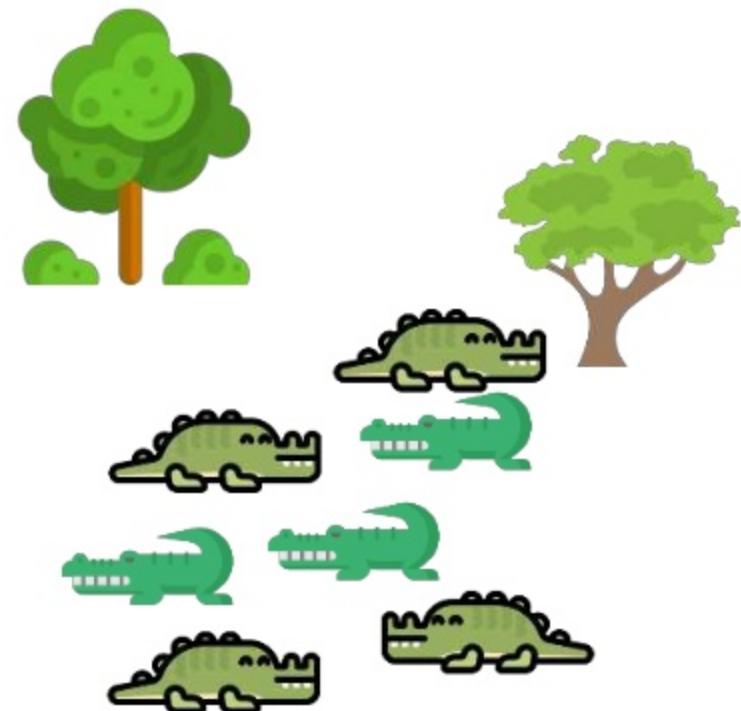
Difference

		
Size	<ul style="list-style-type: none">Crocodiles are larger in size	<ul style="list-style-type: none">Alligators are smaller in size
Snout Width	<ul style="list-style-type: none">Crocodiles have narrow snout	<ul style="list-style-type: none">Alligators have wider snout



The illustration shows a father and son standing on the left, looking towards a group of alligators on the right. The father is holding his head in confusion, while the son points towards the animals. The background features stylized green trees and bushes.

Use case – Problem Statement



Use case - Implementation

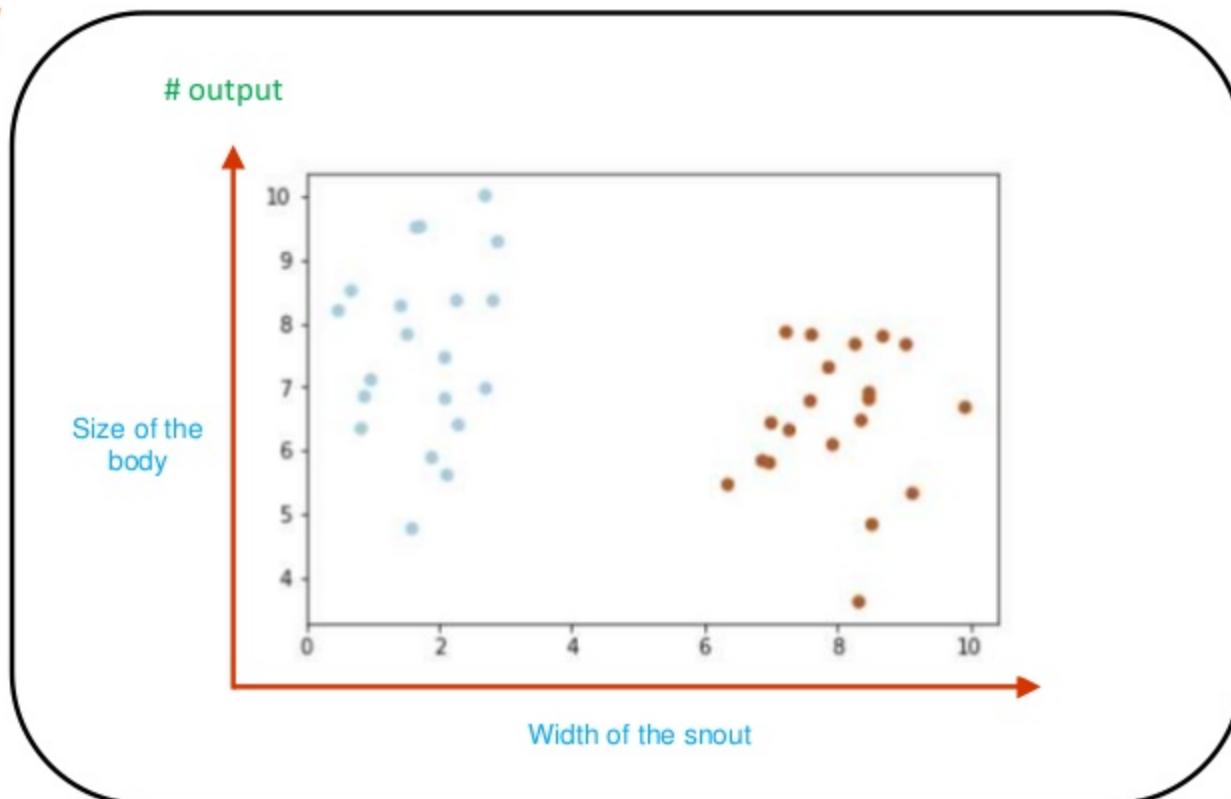


```
import numpy as np
import matplotlib.pyplot as plt
from sklearn import svm
from sklearn.datasets.samples_generator import make_blobs
# we create 40 separable points
X, y = make_blobs(n_samples=40, centers=2, random_state=20)

# fit the model, don't regularize for illustration purposes
clf = svm.SVC(kernel='linear', C=1000)
clf.fit(X, y)

plt.scatter(X[:, 0], X[:, 1], c=y, s=30, cmap=plt.cm.Paired)
```

Use case - Implementation



Use case - Implementation



```
# fit the model, don't regularize for illustration purposes
clf = svm.SVC(kernel='linear', C=1000)
clf.fit(X, y)

plt.scatter(X[:, 0], X[:, 1], c=y, s=30, cmap=plt.cm.Paired)
plt.show

# plot the decision function
ax = plt.gca()
xlim = ax.get_xlim()
ylim = ax.get_ylim()

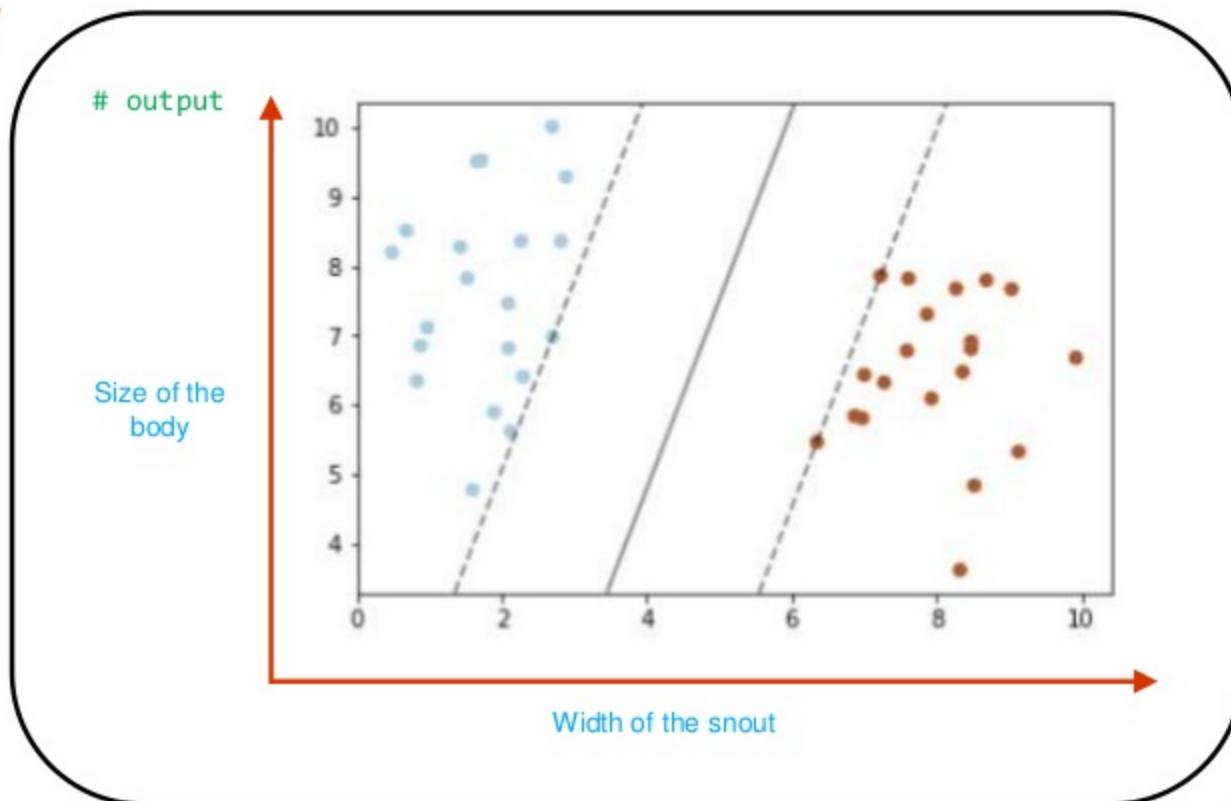
# create grid to evaluate model
xx = np.linspace(xlim[0], xlim[1], 30)
yy = np.linspace(ylim[0], ylim[1], 30)
YY, XX = np.meshgrid(yy, xx)
xy = np.vstack([XX.ravel(), YY.ravel()]).T
Z = clf.decision_function(xy).reshape(XX.shape)
```

Use case - Implementation

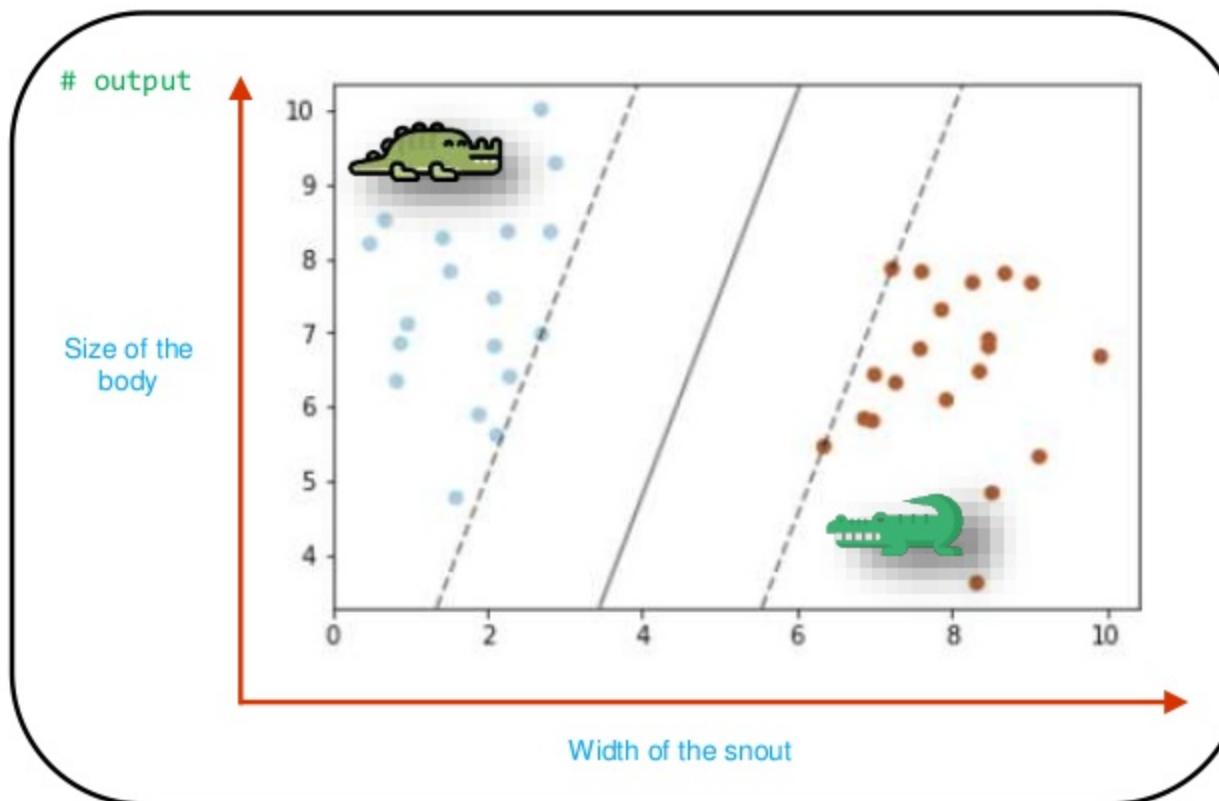


```
# plot decision boundary and margins
ax.contour(XX, YY, Z, colors='k', levels=[-1, 0, 1], alpha=0.5,
            linestyles=['--', '--', '--'])
# plot support vectors
ax.scatter(clf.support_vectors_[:, 0], clf.support_vectors_[:, 1],
           s=100,
           linewidth=1, facecolors='none')
plt.show()
```

Use case - Implementation



Use case - Implementation



Conclusion

Congratulations!

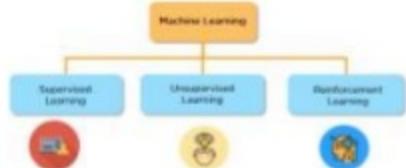
We have demonstrated
Support vector machine by
segregating the two classes

Where the blue data points
represents crocodiles and the
brown data points represents
alligators

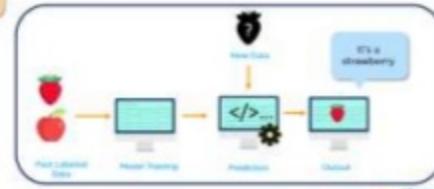
The hands on example will help
you to encounter any Support
Vector Machine project in future.

Key Takeaways

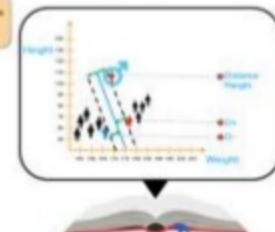
What is Machine learning?



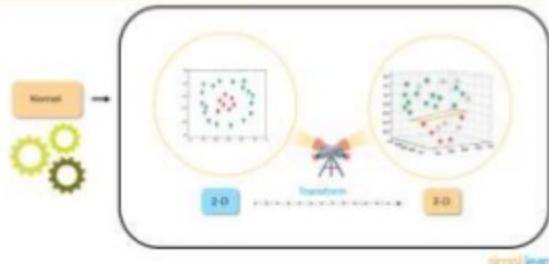
Why Support Vector Machine?



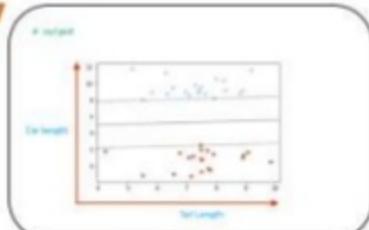
What is Support Vector Machine?

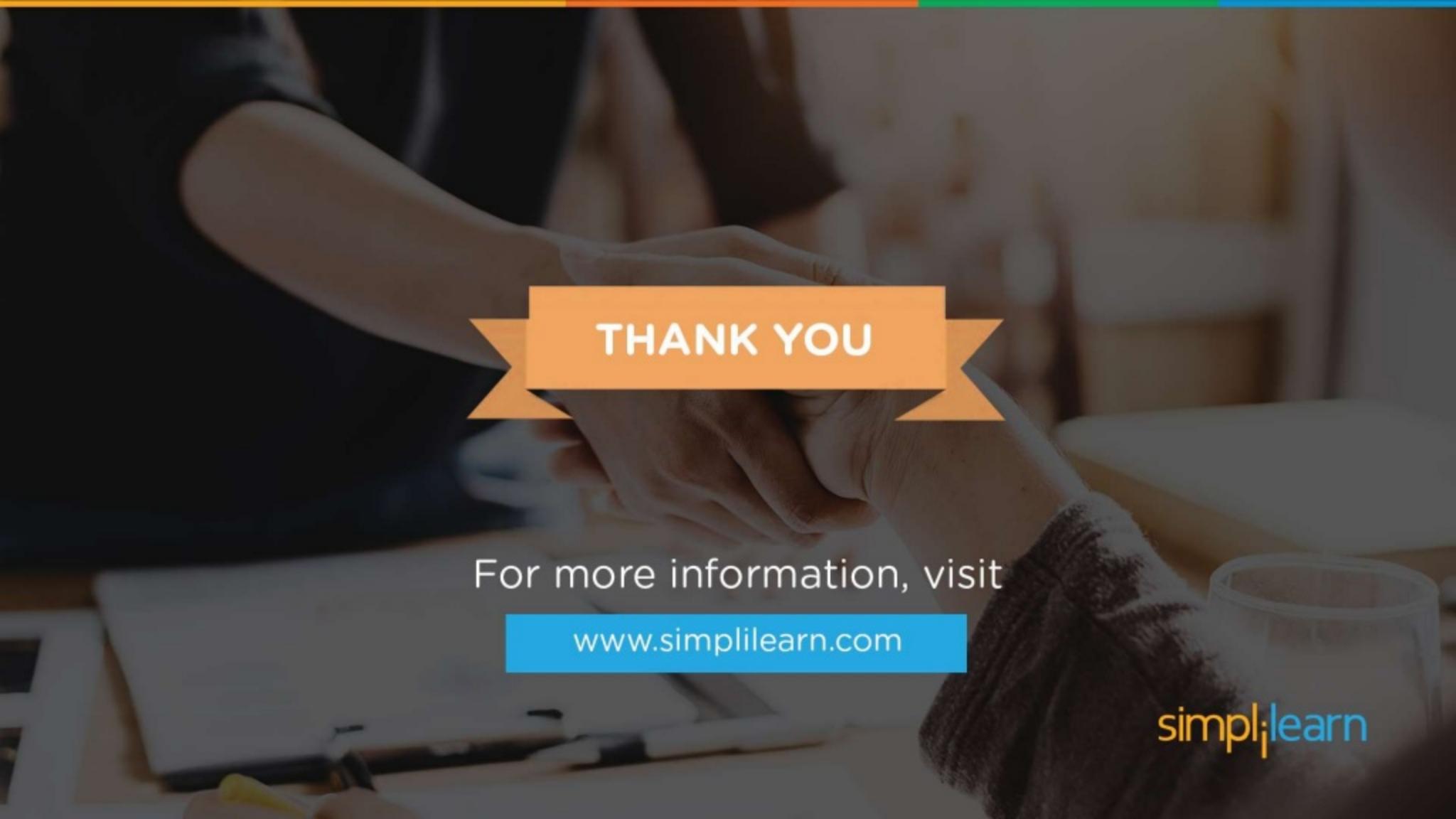


Understanding Support Vector Machine



Use case





THANK YOU

For more information, visit

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