

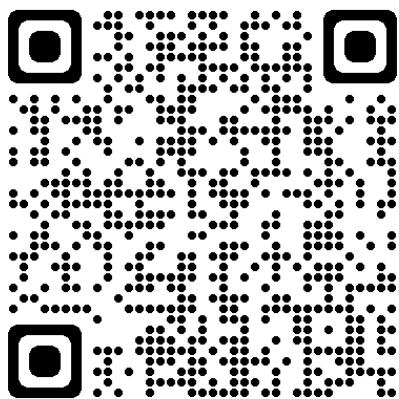


An AI Singapore Student Chapter

Advanced ML Workshop

Day 3

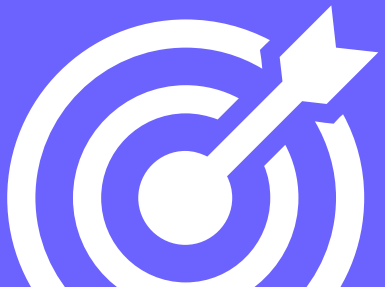




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Learning Objectives



Model Selection



Hyperparameter Tuning



Saving and Loading ML Model

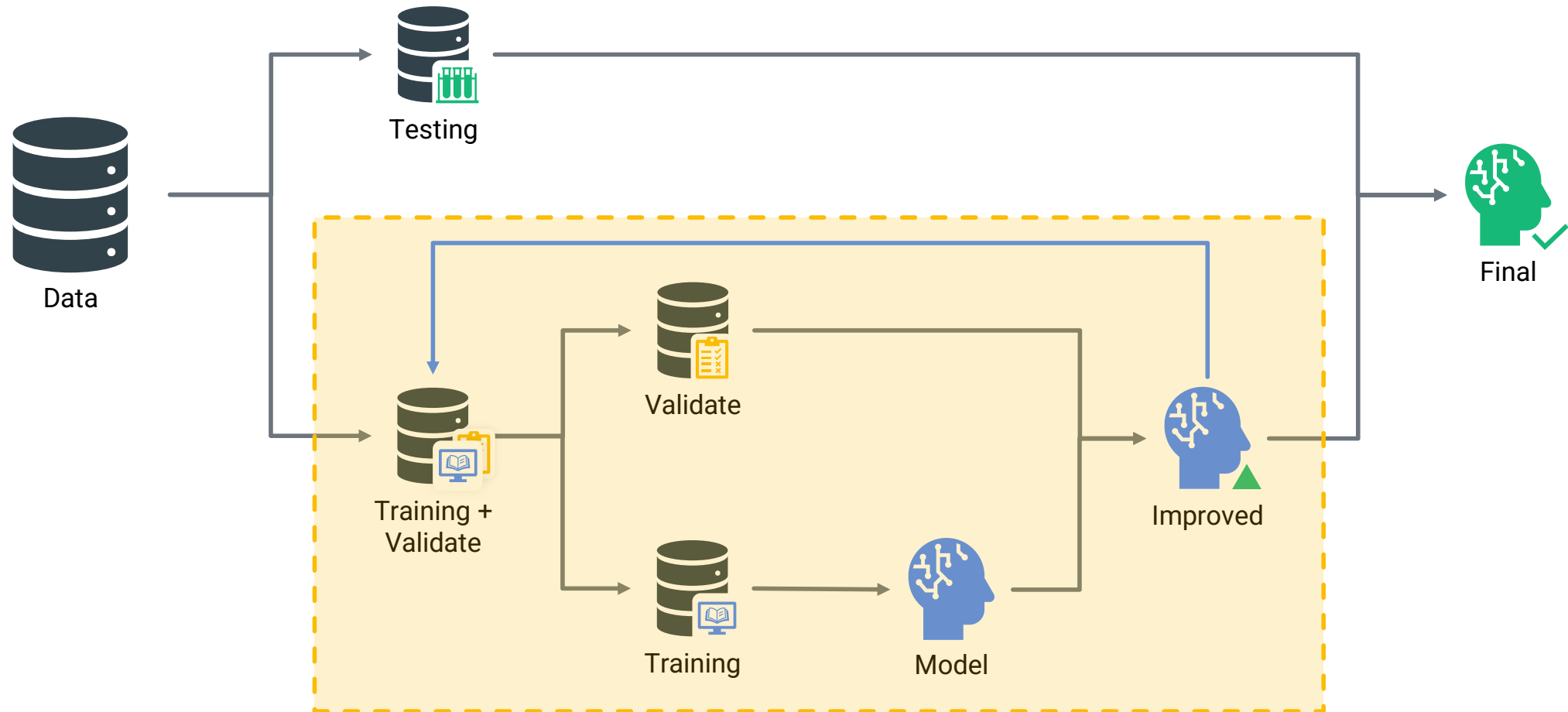


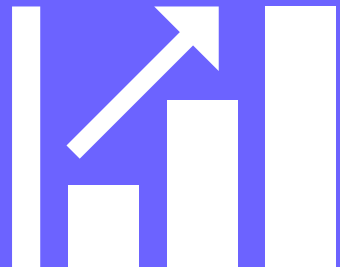
Feature Selection



Feature Engineering

Actual Diagram

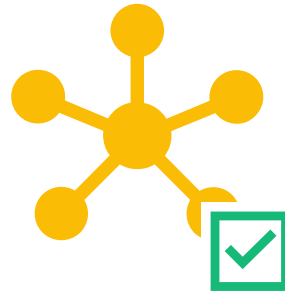




Model Improvement



Model Selection

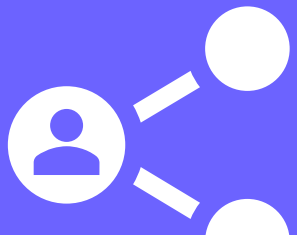


Feature Selection



Model Tuning

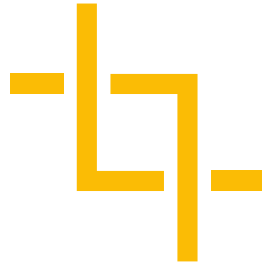
***Assume* we want to
post an image on
social media. What do
we do?**



Posting Images



Image Selection



Cropping Image



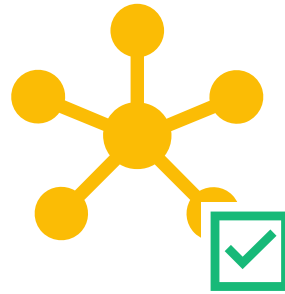
Editing Image



Model Improvement



Model Selection

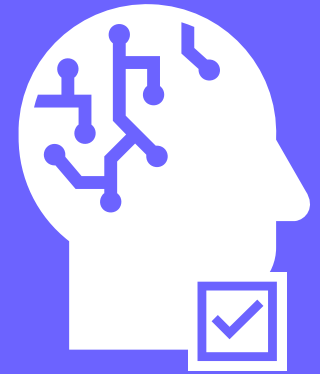


Feature Selection



Model Tuning

Model Selection



Before posting a picture...

1



2

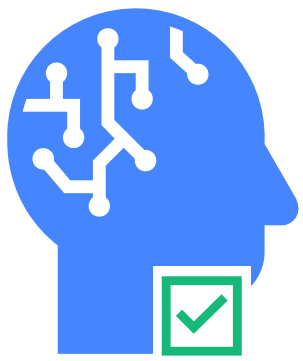


3



4





It is the selection of the most optimal and well-suited model to complete the task with a good fit

What is Model Selection?





Why Model Selection?



There are over a dozen models in sklearn library



All models will perform differently on the same task

It is our job to find the
best performing,
best fit,
best efficiency
Model given our data



How to select?



Score



Time



Explainability



Score

Regression: RMSE (*lower* is better)

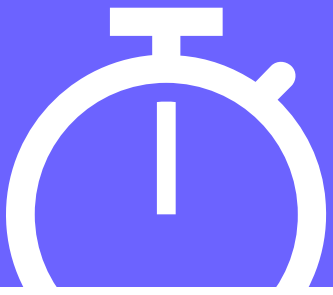
Classification: Accuracy & F1 Score (*higher* is better)



Time

Metrics is in Seconds

Lower is better



When to use?

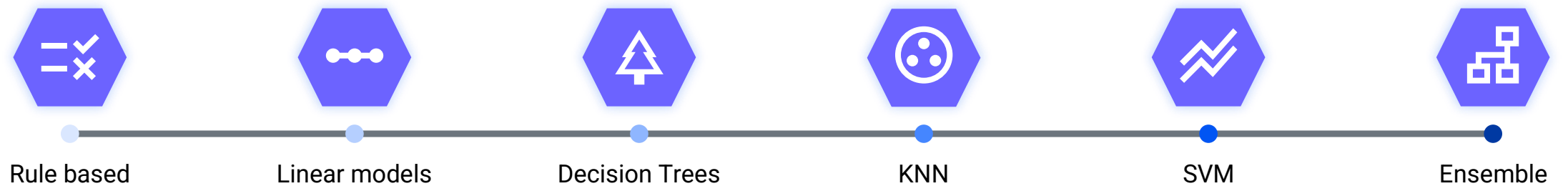
Model A

- Accuracy: 0.912
- F1 Score: 0.90
- Fit Time: 25.432 seconds

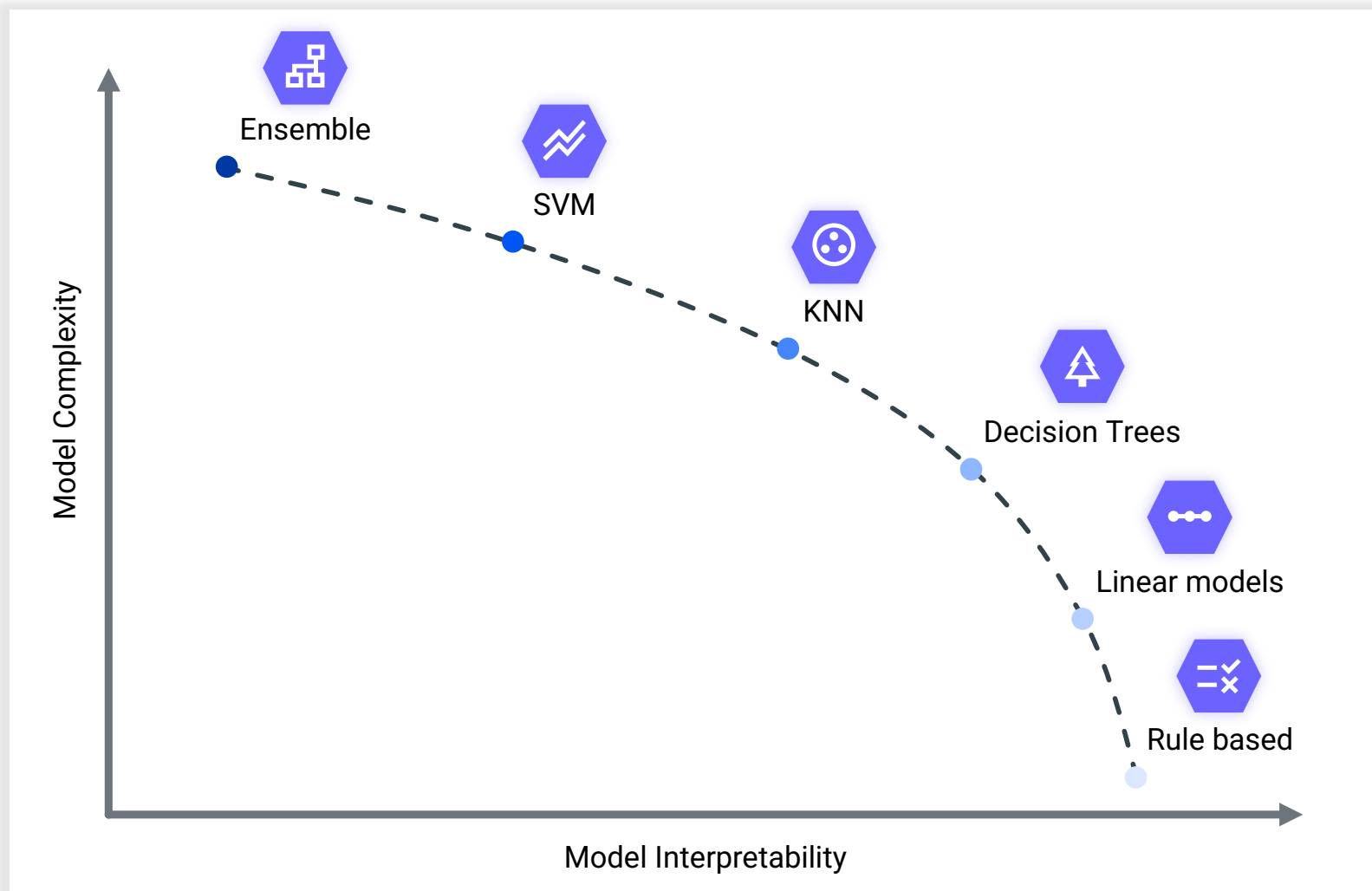
Model B

- Accuracy 0.900
- F1 Score: 0.890
- Fit Time: 2.854 Seconds

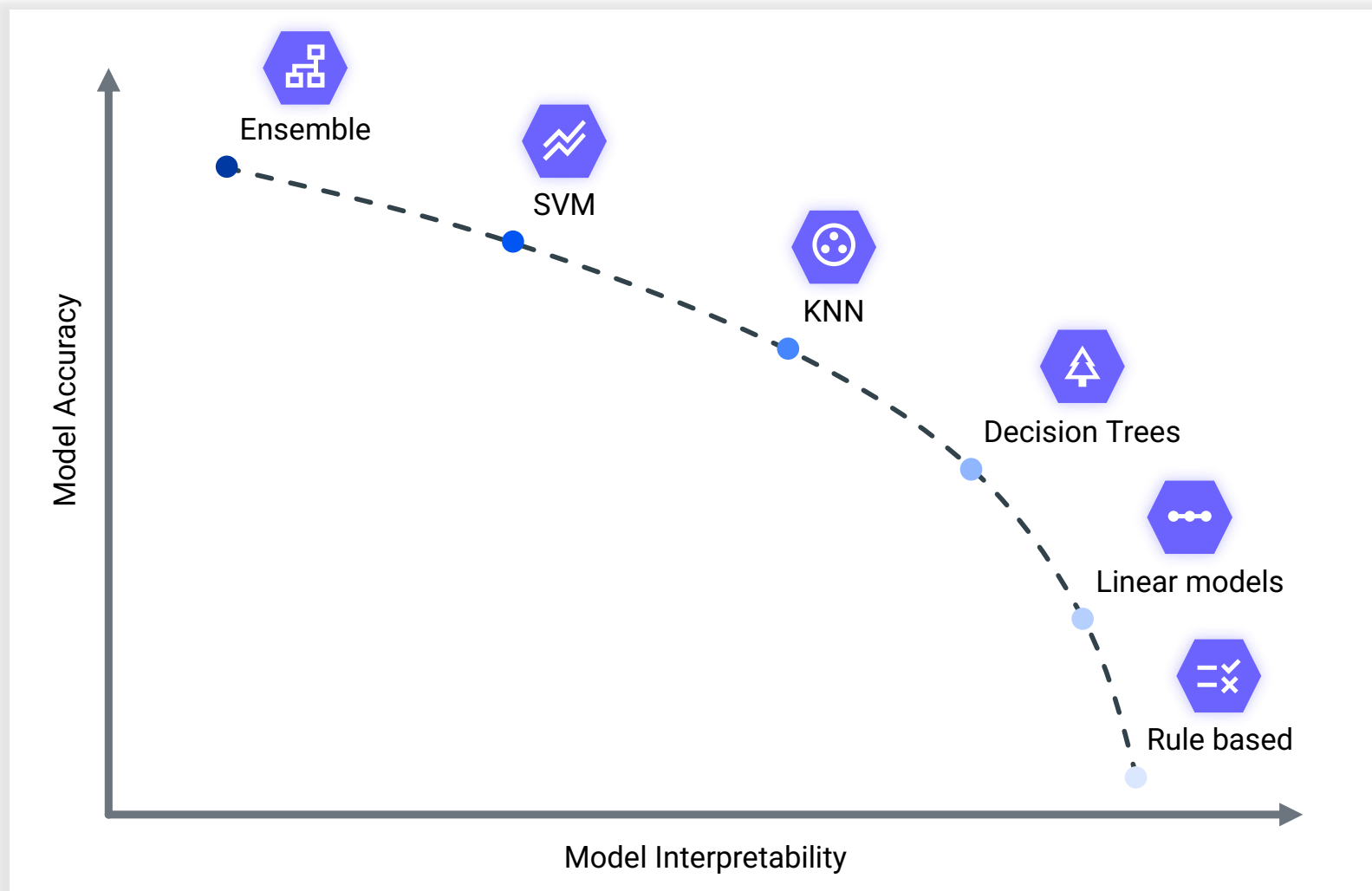
Model Complexity



Model Complexity



Model Complexity





Why is interpretability so important?



People want to know what is going on behind the scenes



Important in problems especially dealing with human life



Improves credibility of your model if able to explain model



When to use?

Random Forest

- Accuracy: 0.912
- F1 Score: 0.90
- Fit Time: 25.432 seconds

Decision Tree

- Accuracy 0.900
- F1 Score: 0.890
- Fit Time: 2.854 Seconds

Practice Time!

8 Minutes

Please attempt exercise 1

We will go through the exercises later

Times up

We will now go through the exercises



Knowledge Check

> Based on the results in exercise 3, which model should be selected?

- A. Linear Regression
- B. Decision Tree Regressor
- C. K-Neighbours Regressor
- D. Support Vector Regressor



Knowledge Check

Model	RMSE	Fit Time
Logistic Regression	10293	0.18s
Decision Tree	8934	0.02s
Support Vector	8329	0.49s
Random Forest	3829	0.27s

> We should select

- A. Linear Regression
- B. Decision Tree
- C. Support Vector
- D. Random Forest



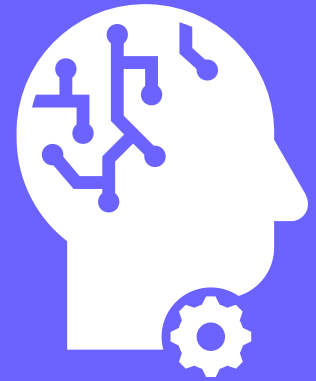
Knowledge Check

Model	RMSE	Fit Time
Logistic Regression	10293	0.18s
Decision Tree	4523	0.02s
Support Vector	4849	0.49s
Random Forest	3829	0.27s

> We should select

- A. Linear Regression
- B. Decision Tree
- C. Support Vector
- D. Random Forest

Hyperparameter tuning



Before posting a picture...



Before posting a picture...



Photo Editor



Brightness



Saturation



Contrast

Before posting a picture...



Photo Editor



Brightness



Saturation



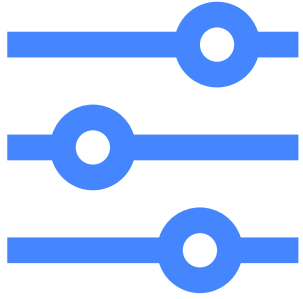
Contrast

Before posting a picture...



Photo Editor

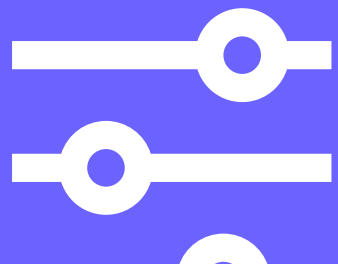




Values in a model that can be used to change the behavior of a ML model



Hyperparameters



Characteristics



Each model have their own unique set of hyperparameters



Huge range of hyperparameters to change for each model and these information can be found on scikit-learn website



Hard to guess best hyperparameters to set for the model

How to choose the best hyperparameters?

**How to choose the best
hyperparameters?**

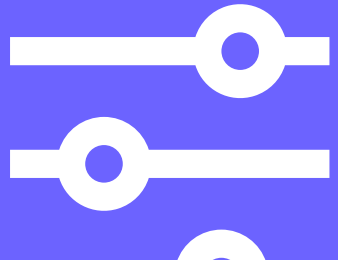
Hyperparameter Tuning

Hyperparameter Tuning

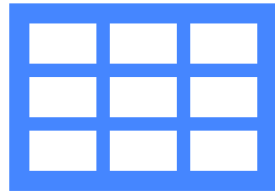


Hyperparameter Tuning

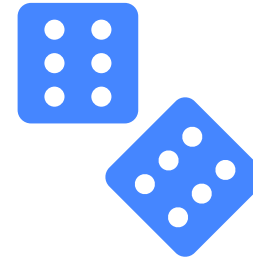
<i>Model</i>	A	B	C	0.80
<i>Model</i>	1	1	1	0.71
<i>Model</i>	1	1	2	0.79
<i>Model</i>	1	2	1	0.88
<i>Model</i>	1	2	2	0.77



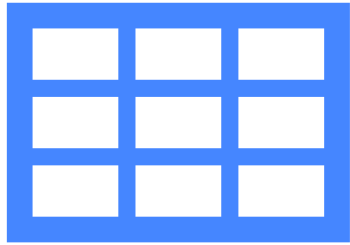
Hyper tuning functions



Grid Search CV



Random Search CV

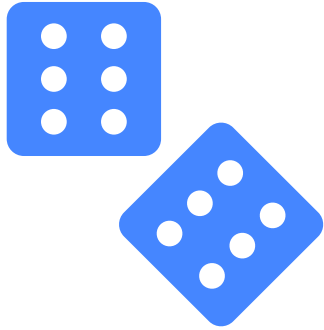


Grid Search CV

Loops through all specified range of hyperparameters

Takes a large amount of time (*no joke*) and resources

Achieves best performance



Random Search CV

Randomly selects n combinations of hyperparameters

Takes shorter amount of time (depending on n)

Less accurate (depending on n)

Where n is the number of combinations to attempt



Knowledge Check

> Which of the following statements are True

- A. Grid Search CV and Random Search CV are identical
- B. Grid Search CV can find parameters faster than Random Search CV
- C. Random Search CV is more accurate the Grid Search CV
- D. Random Search CV usually finds parameters faster than Grid Search CV

Practice Time!

10 Minutes

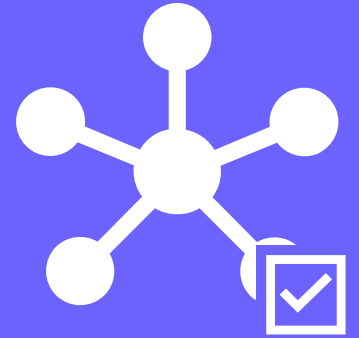
Please attempt exercise 2

We will go through the exercises later

Times up

We will now go through the exercises

Feature Selection





Choosing best features to keep
and eliminating features which
poorly affects the performance

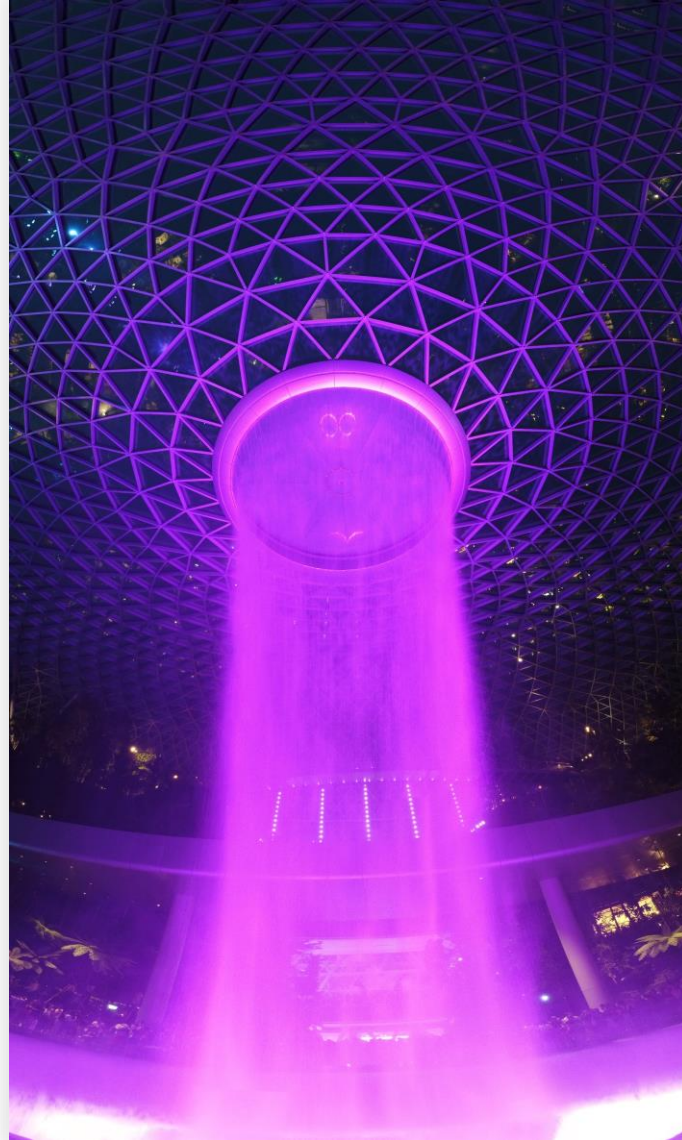
What is Feature Selection



Before posting a picture...



Before posting a picture...

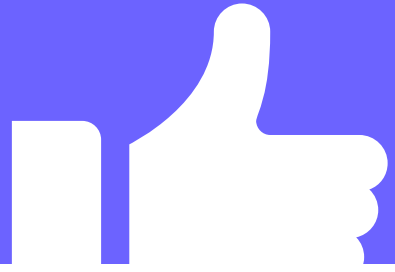


Before posting a picture...



Before posting a picture...





Benefits



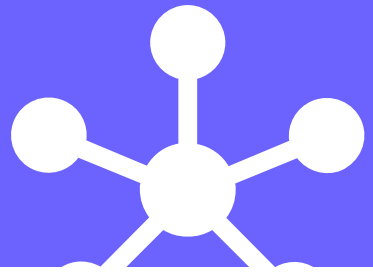
Reduces number of input, allowing easier use of model



Improves performance and training speed of the model



Reduces complexity and overfitting



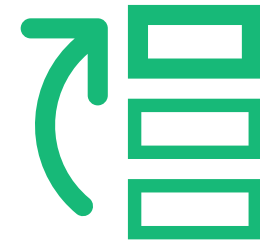
Feature Selection



Research



RFECV



Feature
Importance

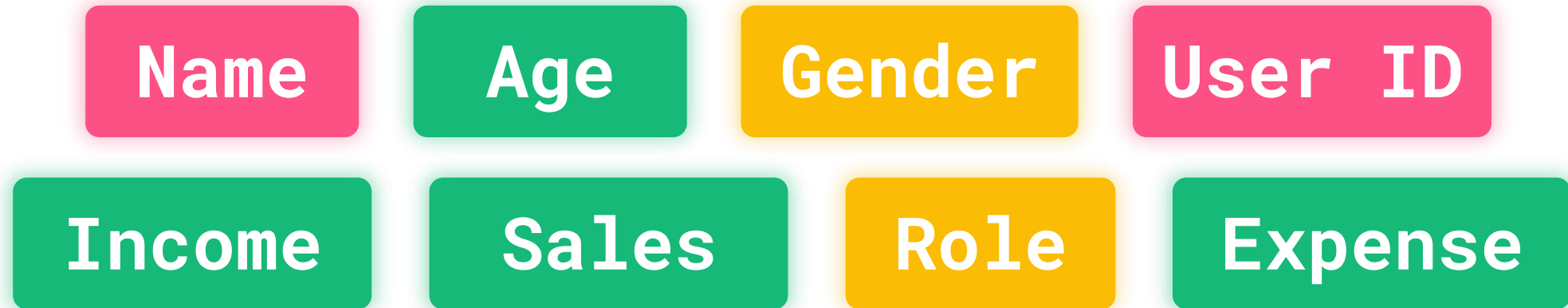
Example

Task: Forecast sales of company

Name	Age	Gender	User ID
Income	Sales	Role	Expense

Example

Task: Predict sales of company





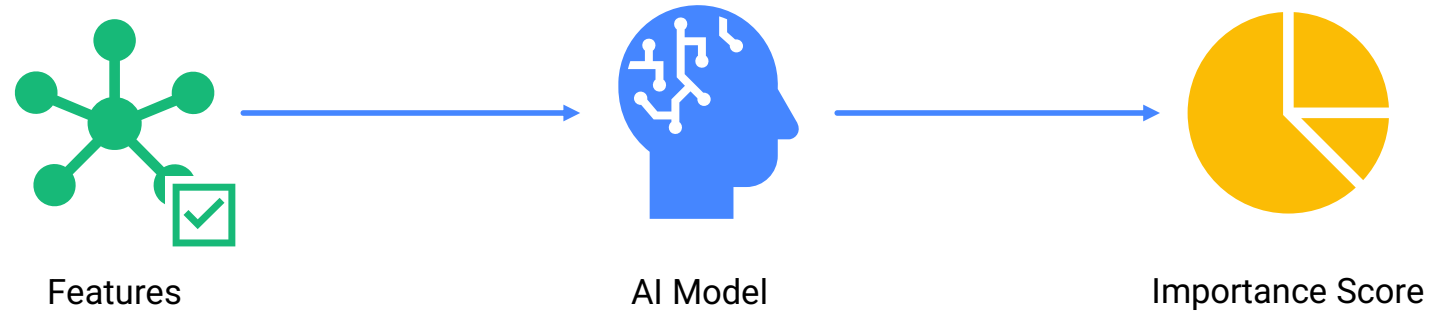
Feature Importance

Assigns a score to each feature based on usefulness of that feature

Highlights more important features through scores

Different model have different scores, some however do not even have such a score

Understanding Feature importance



Problem

We cannot apply cross validation and we cannot gauge with a simple score.



RFECV

Evaluates specific model to find optimal features

Evaluates all possible combination of features

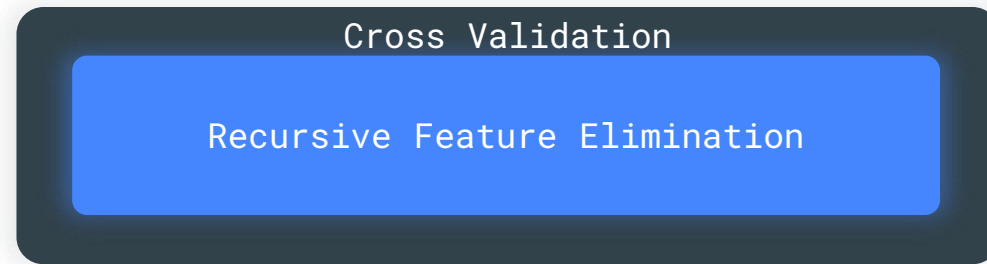
Includes cross validation for fair evaluation

How RFECV works?

Cross Validation

RFECV

How RFECV works?

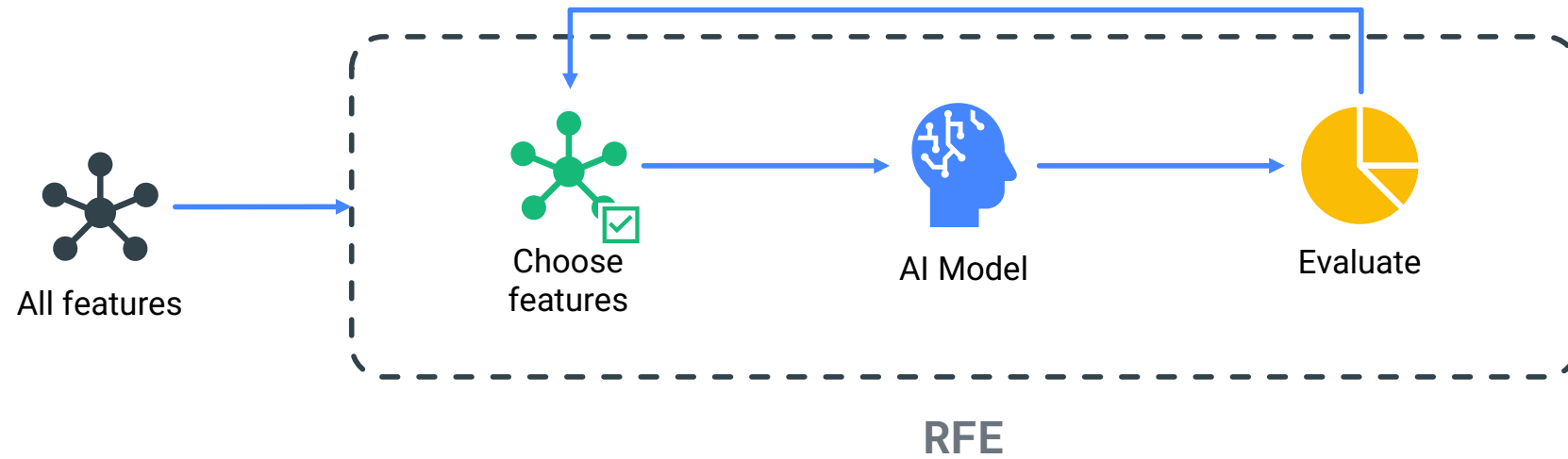


RFECV

How RFE works?

Recursive Feature Elimination

How RFE works?





Knowledge Check

> Which of the following is a possible reason to use RFECV to select features

- A. It assigns a score to each feature
- B. It includes cross validation for a more accurate feature selection process
- C. It is simply the best feature selection method



Knowledge Check

> Which of the following is true

- A. All models have a feature importance score
- B. All models have the same type of feature importance score
- C. Different models have different feature importance scores. Some don't have any feature importance score

Practice Time!

10 Minutes

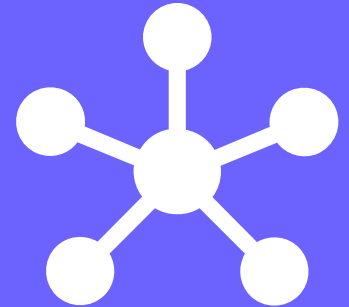
Please attempt exercise 3

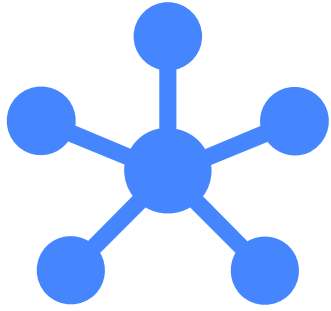
We will go through the exercises later

Times up

We will now go through the exercises

Feature Engineering





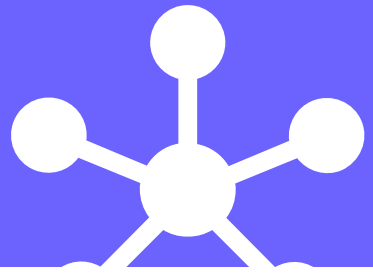
Process of using domain knowledge to transform raw data into features that better represent the problem

What is it?



Before posting a picture...





How to?



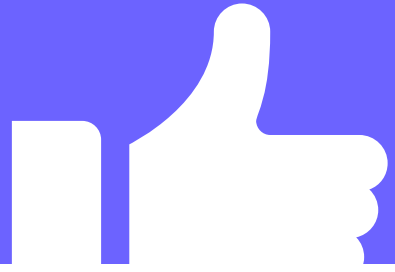
Research



Observations

Saving & Loading Model





Benefits



Allows us to use models multiple times by training them only once



Allows others to easily use your model without much work



Allows us to deploy our models

Practice Time!

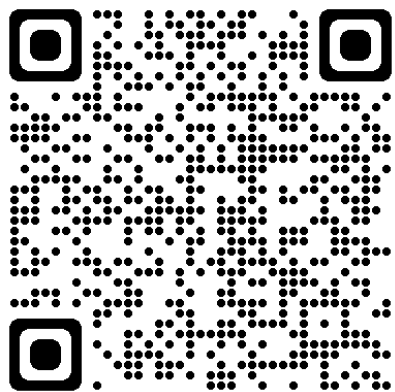
8 Minutes

Please attempt exercise 3

We will go through the exercises later

Times up

We will now go through the exercises



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Attendance

