

Hyperparameter Tuning

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Apa yang akan kita bahas?

What is Hyperparameter
Tuning?

Why do we need
Hyperparameter Tuning?

Hyperparameter Tuning
in Linear Regression

Hyperparameter Tuning
in Random Forest

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Hyperparameter Tuning

What is it?

What is Hyperparameter Tuning?

Hyperparameter = settings that manage how a model 'learns'.

Example:

- In Random Forest, we can adjust how many decision trees that it 'creates'.
- In Random Forest, we can adjust the maximum depth of each Decision Trees.
- In K-Nearest Neighbor, we can adjust how many nearest neighbors to see (the number of 'k').
- etc.

What is Hyperparameter Tuning?

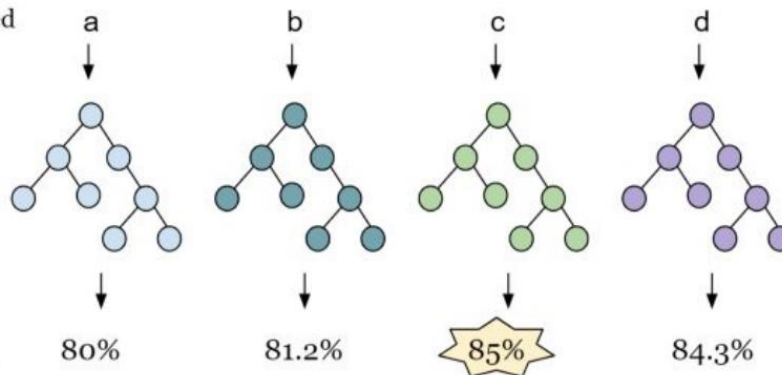
Hyperparameter can improve Machine Learning Model

Test_Hyperparameters = [a, b, c, d]

Hyperparameter used
to make the model

model

Accuracy on test set



What is Hyperparameter Tuning?

Sometimes, tuning these settings can improve model performance.

However, please don't fall into a mistaken mindset!

- If a model performs poorly, doing Hyperparameter Tuning might not improve the model.
- Hyperparameter Tuning is our FINAL attempt to improve the accuracy of our CHOSEN model.

What is Hyperparameter Tuning?

Hyperparameter Tuning is **NOT**:
From a 60% accuracy >>> to 90% accuracy.

Hyperparameter Tuning is:
From a 85% accuracy >>> to 88.5% accuracy.

But, Hyperparameter Tuning is not always improve the model performance.
Sometimes it can be:
From a 88% accuracy >>> to 86.3% accuracy.

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Hyperparameter Tuning

Why Hyperparameter
Tuning?

Why Hyperparameter Tuning?

Asumsi tes antigen itu sekitar 400 ribu tes per hari. Bila kita memiliki akurasi 85%, maka ada 15% = 60 ribu orang yang salah diagnosa.

Bila kita memiliki akurasi 88%, maka 'hanya akan ada' 48 ribu orang yang salah diagnosa. Selisihnya adalah **12 ribu kasus**.

Berarti, ada **12 ribu kasus** COVID yang seharusnya bisa diamankan, per hari.

Jadi jangan meremehkan kenaikan 2-3%...

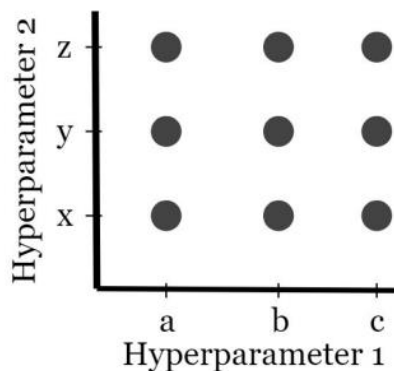
How to do Hyperparameter Tuning?

Grid Search

Pseudocode

```
Hyperparameter_One = [a, b, c]
```

```
Hyperparameter_Two = [x, y, z]
```

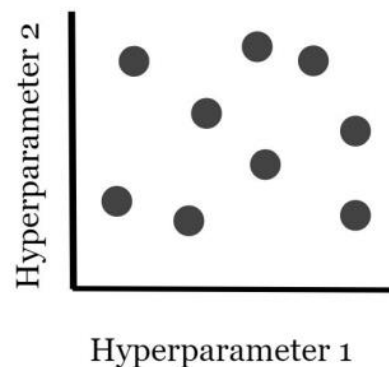


Random Search

Pseudocode

```
Hyperparameter_One = random.num(range)
```

```
Hyperparameter_Two = random.num(range)
```



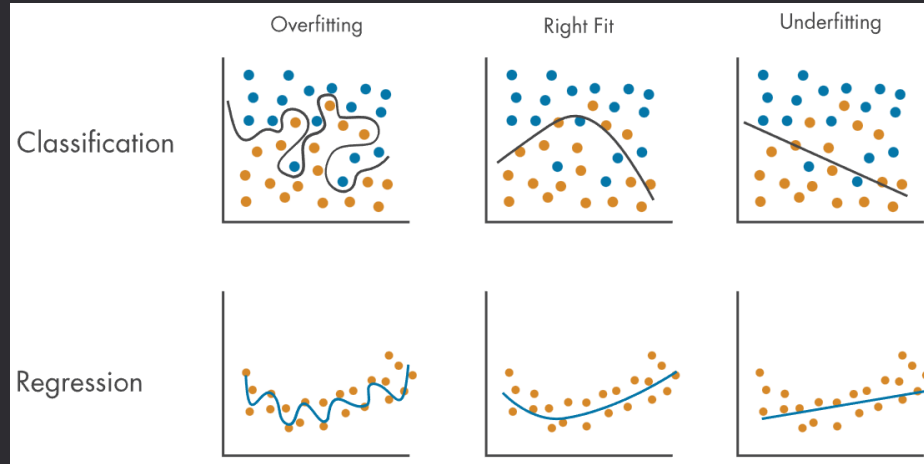
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Hyperparameter Tuning

Regularization in Linear Regression

Regularization in Linear Regression

While not essentially a 'Hyperparameter Tuning' regularization in Linear Regression attempts to avoid overfitting by giving 'penalty' to 'insignificant' features.



Regularization in Linear Regression

- Ridge Regression: attempts to minimize regression coefficients.
- Lasso: if a predictor is deemed 'insignificant', the coefficient will be made 0.
- Elastic Net: combines Ridge and Lasso.

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Hyperparameter Tuning

Hyperparameter Tuning in
Random Forest

Random Forest Tuning

Guide on How to Tune Random Forest:

<https://www.analyticsvidhya.com/blog/2020/03/beginners-guide-random-forest-hyperparameter-tuning/>

Random Forest Tuning

Hyperparameter 1: Max Depth Max Depth

How deep a decision tree will grow

- Deeper Tree = More Complex
- Too Shallow = will not be able to model relationships between variables
- Too Deep = Overfitting

Random Forest Tuning

Hyperparameter 2: n_estimators

N_estimators = number of Trees spawned

- Too many trees = model becomes heavy, and the law of diminishing return will occur
- Too few trees = model tend to overfit
- If number of tree = 1, then it's the same as Decision Tree

Random Forest Tuning

Hyperparameter 3: `min_sample_split`

If `min_sample_split` = 2, then the tree will split itself until each nodes at the bottom are completely pure.

This makes the tree grows in size and can overfit

Thanks!

Do you have any questions?

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