Hyperparameter Tuning

What is Hyperparameter Tuning?
In Machine Learning, there are **two types of parameters**:

1. Model Parameters (Learned Automatically)
These are learned from data during training.
Example:

- Weights in Linear Regression
- Coefficients in Logistic Regression
- Node splits in Decision Trees

You **do NOT set these manually**

Hyperparameter Tuning

2. Hyperparameters (Set by Us Before Training)
These control **how the model learns**.
Examples:

- k in KNN
- max_depth in Decision Tree
- n_estimators in Random Forest
- learning_rate in Gradient Boosting

These **must be chosen carefully**
Wrong values = Bad model performance

Hyperparameter Tuning = Finding the BEST combination of hyperparameters for maximum model performance.

Hyperparameter Tuning

Why Do We Need Hyperparameter Tuning?

Because:

- Too simple model → **Underfitting**
- Too complex model → **Overfitting**

Correct hyperparameters → **Best Generalization**

Goal: **Maximize accuracy on unseen data**

Hyperparameter Tuning: Types

1) GridSearchCV:

GridSearchCV is an **automated hyperparameter tuning method** that:

- Tries **all possible combinations** of hyperparameters
- Uses **Cross-Validation (CV)**
- Finds the **best performing model**

Hyperparameter Tuning: 2 Main Types

2) RandomizedSearchCV

Instead of testing all combinations, it **randomly selects some combinations.**

Pros:

- Much faster than GridSearch
- Works well for large parameter spaces
- Finds near-optimal models quickly

Cons:

Does not guarantee optimal result, since it uses Random Search

Best used when you have large datasets, deep models or limited computation time

Heading Goes Here

Fhdsklf
Fjdsklf
Fjskldf