# What are hyperparameters? Explain in simple terms.

Hyperparameters in machine learning algorithms are parameters that are set before the learning process begins. They are not learned from the data but are predefined by the user or the data scientist.

Hyperparameters are different from model parameters, which are learned during the training process by adjusting them based on the training data. Model parameters are updated through optimization algorithms such as gradient descent, while hyperparameters remain fixed throughout the training process.

Selecting appropriate hyperparameters is often an iterative process that involves experimentation and tuning.

Examples of hyperparameters include the learning rate in gradient descent, the number of hidden layers and neurons in a neural network, the regularization parameter in linear regression, the depth of a decision tree, and the kernel type and its associated parameters in support vector machines.

# What does our code do in ToyCode1 colab?

The code uses Bayesian optimization to find the best set of hyperparameters for a Support Vector Machine (SVM) classifier on the Iris dataset.

Here's a breakdown of what the code does:

1. Import necessary libraries.

2. Load the Iris dataset.

3. It defines the search space for the hyperparameters of the SVM classifier. In this case, the hyperparameters being tuned are `C`, `gamma`, and `kernel`. The search space specifies the range or values that each hyperparameter can take.

4.Create an instance of the SVM classifier.

5. Initializes the Bayesian optimization process using `BayesSearchCV`. It specifies the classifier, the parameter search space, the number of iterations or evaluations to perform (`n\_iter`), the number of cross-validation folds (`cv`), and a random seed (`random\_state`).

6. Fit the model to the data

The code automates the process of searching for the best hyperparameters for an SVM classifier using Bayesian optimization.

# What do we mean by cross validation?

In this case, `cv=5` means that 5-fold cross-validation is being performed. The dataset (in this case, the Iris dataset) will be divided into 5 equal-sized subsets or folds. The model will be trained and evaluated 5 times, each time using a different fold as the validation set and the remaining 4 folds as the training set. This process ensures that each data point is used for both training and validation, improving the reliability of the performance estimation.

# Explain various hyperparameters in SVM.

Some of the common hyperparameters for SVMs and their meanings:

1. C (Penalty parameter): A smaller `C` value allows for a larger margin but may tolerate more misclassifications, while a larger `C` value aims to classify all training examples correctly but may result in a narrower margin. It controls the regularization strength in SVM.

2. Kernel: The `kernel` hyperparameter determines the type of function used to transform the input data into a higher-dimensional feature space. Common kernel functions include:

- Linear Kernel (`kernel='linear'`): Performs linear classification in the input space.

- Radial Basis Function (RBF) Kernel (`kernel='rbf'`): Uses a Gaussian radial basis function to transform the data.

- Polynomial Kernel (`kernel='poly'`): Applies a polynomial function to the data.

3. Gamma: A low `gamma` value indicates a broader influence, where points farther from the decision boundary have more influence. A high `gamma` value means points closer to the decision boundary have higher influence, resulting in a more complex decision boundary.