**📌 Parametric Models**

**✅ Definition:**

Parametric models **assume a specific form or structure** for the function that maps inputs to outputs. Once you estimate a **finite number of parameters**, the model is fully defined.

**🧠 Key Characteristics:**

* **Fixed number of parameters**
* **Fast to train**
* Require **assumptions** about data (like linearity, normality)
* Work well with **smaller datasets**

**📊 Examples:**

| **Model** | **Assumption** |
| --- | --- |
| Linear Regression | Linear relationship between X and y |
| Logistic Regression | Sigmoid relationship for binary outcomes |
| Naive Bayes | Feature independence |
| Neural Networks (basic) | Fixed architecture (layers, neurons, etc.) |

**📌 Non-Parametric Models**

**✅ Definition:**

Non-parametric models **do not assume a fixed functional form**. They try to learn the structure from the data itself, often leading to more flexibility.

**🧠 Key Characteristics:**

* **Flexible** (can fit complex patterns)
* **Infinite parameters** in theory (they grow with data)
* **Require more data** to generalize well
* Slower and more **computationally intensive**

**📊 Examples:**

| **Model** | **Behavior** |
| --- | --- |
| K-Nearest Neighbors (KNN) | Memorizes training data |
| Decision Trees | Builds tree from data splits |
| Random Forests | Ensemble of decision trees |
| Support Vector Machines | Decision boundary determined by support vectors |
| Gaussian Processes | Uses entire dataset as part of prediction |

**🚀 Summary Table:**

| **Feature** | **Parametric** | **Non-Parametric** |
| --- | --- | --- |
| Assumes structure | Yes | No |
| # Parameters | Fixed | Grows with data |
| Training Speed | Faster | Slower |
| Flexibility | Lower | Higher |
| Data Requirement | Low to Medium | High |
| Examples | Linear/Logistic Regression | KNN, Trees, SVM, Random Forest |