Machine Learning Development Lifecycle

Building a **Machine Learning (ML) model** is like **cooking a dish** 🍛—you need the **right ingredients (data), proper preparation (training), and testing (evaluation)** before serving it!

Let's break it down into **7 easy steps** 👇

1️⃣ Problem Definition 🎯

👉 **What do we want to solve with ML?**

- Clearly define the **goal of the ML model**.

🔷 **Example:**

- **Spam detection** → Identify whether an email is spam or not.
- **Movie recommendation** → Suggest movies based on user preferences.

2️⃣ Data Collection & Preparation 📊

👉 **Find and clean data for training.**

- Gather **high-quality, relevant data**.
- **Remove missing values, fix errors, and normalize data** for better performance.

🔷 **Example:**

- For **spam detection**, collect **thousands of emails** (spam + non-spam).
- For **house price prediction**, collect **house size, location, and price**.

3️⃣ Data Splitting 📂

👉 **Divide data into 3 parts:**

- **Training Set (70-80%)** → Used to train the model.
- **Validation Set (10-15%)** → Helps tune model parameters.
- **Test Set (10-15%)** → Checks the final accuracy.

🔷 **Example:**

- In spam detection, out of **10,000 emails**,
  - **8,000 emails** → Training
  - **1,000 emails** → Validation
  - **1,000 emails** → Testing

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4 Model Selection & Training 🏋️

👉 **Choose the best ML algorithm** and **train it on data**.

- Select **Supervised, Unsupervised, or Reinforcement Learning** based on the problem.
- Train the model by **feeding it data and adjusting parameters**.

🔷 **Example:**

- For spam detection → **Use Naïve Bayes or LSTM model**.
- For house price prediction → **Use Linear Regression**.

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5 Model Evaluation & Fine-Tuning 📈

👉 **Test how well the model performs and improve it.**

- Use **accuracy, precision, recall, and F1-score** to measure performance.
- If the model is **not good**, fine-tune it by:
  - **Adding more data** 📊
  - **Changing the model type** 🔄
  - **Adjusting hyperparameters** ⚙️

🔷 **Example:**

- If spam detection **misclassifies too many emails**, we **adjust the learning rate or add more training data**.

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6 Model Deployment 🚀

👉 **Make the ML model available for real users.**

- Convert the trained model into an **API** or **software system**.
- Deploy it to **cloud platforms** (AWS, Google Cloud, Lightning AI, etc.).

🔷 **Example:**

- Gmail integrates the spam detection ML model to **automatically filter emails** in real-time.

7️⃣ Continuous Monitoring & Improvement 🔄

👉 **Keep checking and updating the model.**

- ML models **need updates** as new data arrives.
- If accuracy drops, **retrain with fresh data**.

🔷 **Example:**

- Netflix **keeps improving** its recommendation system as **user preferences change**.