Federated Learning

### Federated learning enables training AI models on decentralized data sources, such as mobile devices or edge sensors, without transferring the raw data to a central server. Instead, techniques like federated averaging are used to learn a shared model while localizing the training data collaboratively.

# How It Works

1. Using the local dataset, a model is trained on the smartphone
2. The model is sent to the server
3. The server creates a global model by aggregating all local models
4. The new global model is sent back to all smartphones
5. Each smartphone receives the updated global model

# Frameworks

As of today, there are only a few federated learning frameworks available. The most well-known are Flower, PySyft, TensorFlow Federated, or Paddle FL.

# Types of Federate Learning

**Horizontal Federated Learning:** Data samples are distributed across devices or servers, and the model is trained collaboratively.

**Vertical Federated Learning:** Features are divided between devices, and the model is trained on complementary features.

**Federated Transfer Learning:** Pre-trained models are fine-tuned on decentralized data for specific tasks, reducing the need for extensive local data.

# Use Cases

**Healthcare:** Collaboratively train a decentralized model without sharing confidential medical records. From lung scans to brain MRIs, aggregating medical data and analyzing them at scale could lead to new ways of detecting and treating cancer, among other diseases.

**Finance:** Aggregating customer financial records could allow banks to generate more accurate customer credit scores or improve their ability to detect fraud.

**Industry:** Aggregating sound and image data from factory assembly lines could help with the detection of machine breakdowns or defective products.