# Individual Task 3 - Module 3

# Machine learning: Concepts, Algorithms and Application

## My Personal Pattern Tracker: Track a week of your own choices (like songs listened to or product brands) and analyze if a recommendation system could predict your next choice using supervised learning.

The Data Collection Phase:

To use supervised learning, you need labeled data. This means every choice must be attached to the context in which it happened.

| Day | Time | Song Genre | Artist Type | Mood | Song Played |
|---|---|---|---|---|---|
| Mon | Morning | pop | Indian | Happy | Song a |
| Mon | Night | Lof-fi | International | Sad | Song b |
| Tue | Evening | pop | Indian | Energetic | Song c |
| Tue | Night | Lof-fi | Indian | Relaxed | Song d |
| Wed | Morning | Lof-fi | International | Calm | Song e |
| Thu | Night | pop | Indian | Happy | Son a |
| Fri | Evening | pop | International | Sad | Song d |
| Sat | Morning | Lof-fi | International | Energetic | Song b |

**1.Feature Engineering:** What the AI has

A supervised learning model (like a Random Forest or a Neural Network) doesn't "know" you; it looks for mathematical correlations between your features and your target.

Key variables for prediction:

- Temporal features: Time of day, day of the week, or time since last actions.
- Contextual features: Your physical location, the weather, or your current device.
- Sequential features: The previous song or product you looked at.

**2. The Supervised Learning Test**

- To determine if a system could predict your next choice, ask yourself these three questions after your week of tracking:
- Is there a signal or a pattern?
  If you listened to heavy metal on Monday morning and classical on Tuesday morning in the exact same context, the model will struggle. Supervised learning thrives on consistency. If your habits are erratic, the model's "loss function" will remain high.
- Is the label space too large?
  Predicting a specific song out of 100 million is incredibly hard. However, predicting a genre or a product category is much easier. A model might not know you will pick "Levitating" by Dua Lipa, but it could easily predict you will pick "pop."
- : C. The Cold Start Problem
  Did you buy anything completely new this week? Supervised models generally fail when they encounter a choice you have never made before, as there is no historical data to map that label to your features.
- Ex: "Is this user logging in from a new country suddenly?"

**3. Output**

- The bottom row of your diagram represents the completion layer.
- Visualization: Converting raw coordinates (x, y) into a visual map interface for the "coordinate of friend" feature.
- Push notification: This is a specialized output. When a "friend/family alert" is triggered, the system sends an asynchronous signal to a mobile push service.

- APIs (Application Programming Interface)
- The Mobile bubble acts as the gateway. It requests specific slices of the data from the big data pool so the phone doesn't get overwhelmed with too much information.
- Mapping diagram to a Big Data process transforms a simple response into a high-availability ecosystem. By upgrading from a single database to distributed storage and replacing basic logic with stream processing, the system moves from simply having a location to providing instant, predictive intelligence.
- The goal of this Big Data architecture is to ensure that whether you have ten users or 10 million, the "latency" on immediate checks is seamless and the GPS history is stored safely.

**4. Transforming Life into Math**

- A model can't read "Tired on a Monday," we have to use One-Hot Encoding or labeled encoding to turn your tracked choices into a vector.
- Ex: Input Feature (X): [Time (0-24), Day (1-7), Energy Level (1-10)]

**5. Choosing the "Brain" (The Algorithms)**

- Depending on how complex your week was, different preferred models would perform differently:
- The Logic Tree:
- Working: It creates a flowchart of your life. If it is before 9:00 am and user is at the office: predict "espresso."
- Predictability check: If your week was highly routine, this model would show near 100% accuracy.
- The "Similarity" Check:
- Working: Looks at your current state and finds the k most similar moments from your past week. If 4 out of 5 times you were at home, 8:00 pm, you chose YouTube, it predicts YouTube.
- Predictability check: Great for identifying "moods" but fails you for one-off outlier days.

**6.The Sequence Master:**

- Working: This doesn't just look at where you are; it looks at the order of your choices.
- Predictability: This is what Spotify uses; it captures the flow better than simple timestamps.