Machine Learning – Day 3 Notes

Why Machine Learning Systems Fail

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1. Initial Assumption

I assumed that **Machine Learning fails because models are weak or incorrect**.

This understanding turned out to be misleading.

2. Key Realization

Most Machine Learning problems **do not fail at the model stage**.
They fail **much earlier in the pipeline**.

Even a highly advanced model cannot succeed if earlier steps are flawed.

3. Machine Learning Is a Process

Machine Learning is **not a shortcut** where data is fed into a model to get results.

It is a **step-by-step process**, where:

- Each stage depends on the correctness of the previous one
- Skipping or rushing any step silently damages the final outcome

4. Common Reasons ML Projects Fail

A. Unclear Problem Definition

If the problem is not clearly defined:

- The model may optimize the wrong objective
- Success metrics become meaningless

Real-life example:

- Trying to “predict customer behavior” without specifying whether the goal is:
    - Increasing retention
    - Improving recommendations
    - Reducing churn

Insight:
A model cannot solve a problem that humans have not clearly framed.

B. Poor Data Quality

Data issues are one of the **most common failure points** in ML.

Problems include:

- Missing values
- Incorrect labels
- Noisy or biased data
- Inconsistent formats

Real-life example:

- Predicting house prices using outdated or incorrect property data
- Training a spam detector with wrongly labeled emails

Insight:
Better data often improves results more than a better algorithm.

C. Wrong Evaluation Strategy

If evaluation is incorrect:

- The model may appear accurate but fail in real-world use
- Decisions based on results become unreliable

Real-life example:

- Using accuracy for an imbalanced dataset where most values belong to one class
- Testing on data too similar to training data

Insight:
A model is only as good as how it is evaluated.

5. Why Better Models Don’t Fix These Issues

- A powerful model cannot compensate for:
    - Poor problem framing
    - Messy or misleading data
    - Incorrect evaluation metrics

This explains why many ML projects fail **even with advanced algorithms**.

6. Shift in Understanding

Earlier Thinking

Machine Learning is mainly about:

- Training models
- Improving algorithms
- Increasing accuracy

Updated Thinking

Machine Learning is about:

- Clear thinking from start to end
- Treating ML as a **system**, not just a model
- Ensuring every step is logically sound
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7. Final Takeaway

Machine Learning success depends on the entire pipeline:

Problem Definition → Data Quality → Feature Design → Model → Evaluation → Deployment

Skipping any step quietly breaks everything that follows.

Machine Learning is less about “training models”
and more about **thinking clearly throughout the process**.