Measurement & Unit Testing

AI Engineering - Recitation 3

Outline

Measurement

1. Measurement: The Big Idea
2. Measuring Quality Attributes in ML Systems
3. Activity - Malicious Android Applications
4. Data Collection in Production

Unit Testing

1. Unit Testing Overview
2. Activity - unittest
3. Unit Testing: Importance
4. Writing Unit Tests
5. Limitations

Measurement

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Measurement: The Big Idea

- Measurement is the numerical quantification of the attributes of an object or event, which can be used to compare with other objects or events. (Source: Wikipedia)

- How to measure intangible quantities?
  - Determine what is observable around it, and then measure that.
  - Often not a single quantity
  - Example: Quality of recommendations measured from user feedback.

- Everything is measurable provided you care enough and are willing put in the effort

Measuring Quality Attributes in ML Systems

- Measuring quality attributes is a hard problem to solve
  - Quality attributes in ML systems are mostly intangibles
  - Multiple attributes are required for accurately measurement
- Not all qualities are relevant to every ML system
  - Identify relevant qualities, and then measure them
  - Every quality attribute has a different measure
- Operationalization of a measure is to turn these abstract quality attributes into something observable and measurable.

Activity - Malicious Android Applications

Scenario:

You are part of the team at Google that reviews Play Store apps to determine if they are malicious. With over 3 million apps, around 4000 new apps are added and 70,000 apps are updated every day. You are analyzing an ML system that scans these applications and automatically flag them for a manual review.

Some Qualities to Consider:

- Accuracy
- Training Cost
- Amount of data needed
- Scalability with the number of features considered
- Effort for data cleaning and feature engineering
- Inference Cost
- Cost of updating model with new data
- Model Size
- Robustness
- Interpretability

Reference: SEAI - Fall 2020 - I2: Tradeoffs

Activity - Malicious Android Applications

Quality	Measure	Operationalization

Data Collection in Production

- Operationalization of any measure is dependent on how well the observation data is collected
- A lot of effort is put on telemetry systems in production
  - Gathering user feedback
  - Monitoring model quality
  - Performance monitoring
  - Detecting drifts and feedback loops
- In production ML systems, the model is probably not the most important component.

Unit Testing

Unit Testing

1. Unit Testing Overview
2. In class Activity
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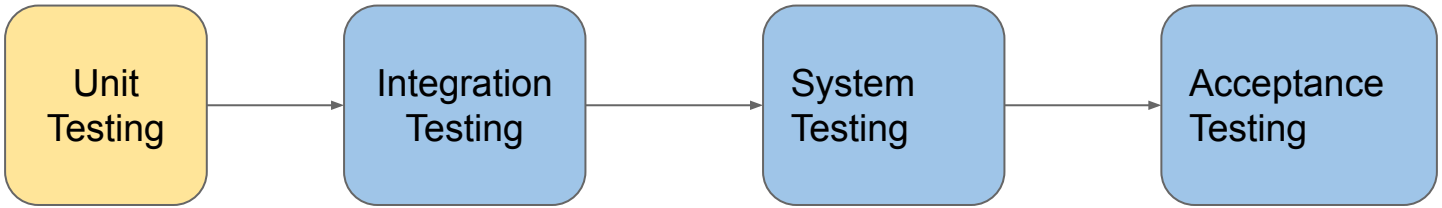
Unit Tests

Unit Tests:

- Main types: manual and automated(preferred)
- Tools Examples: Junit, NUnit, JMockit



Levels of Testing

Unit Testing Activity

Unit Testing: Importance

- Better understanding of goal trying to achieve
- Protect against regression failure
- Documentation
- Find software bugs early
- Code Coverage

Writing Unit Tests

- Descriptive Test Case Name
- 3 A's (Arrange, Act, Assert)
- Appropriate Test Error Message when test fails
- Organize Test Code
- Each test case should be independent of other test cases
- Decompose Code into testable units

Limitations

Hard task if units have many dependencies

Failures may go undetected because of missed scenarios

Do not uncover integration problems

Unreliable Tests

Resources

- Unittest- https://docs.python.org/3/library/unittest.html
- Getting Started with Testing in Python- https://realpython.com/python-testing/
- Mocking objects - https://realpython.com/python-mock-library/#what-is-mocking
- Assert methods - https://docs.python.org/3/library/unittest.html#assert-methods