

5 Testing

Testing is an **extremely** important component of most projects, whether it involves a circuit, a process, power system, or software.

The testing plan should connect the requirements and the design to the adopting test strategy and instruments. In this overarching introduction, given an overview of the testing strategy. Emphasize any unique challenges to testing for your system/design.

5.1 UNIT TESTING

What units are being tested? How? Tools?

Once our AI model is at the point we can begin testing we could use either pytest or unittest for the unit tests. The AI model is one unit. Ideally we will be testing it to make sure it is behaving consistently and outputting the results we want. Unit testing for AI models is not the same as typical software testing and can be quite difficult. They can take a long time because an accurate test requires training the model which is costly even on a modest data set. Some recommendations from experts have been to consider instead of some unit tests using smoke tests. We will consult more with our faculty as we near the test stage to see what would be the best way for our particular model.

5.2 INTERFACE TESTING

What are the interfaces in your design? Discuss how the composition of two or more units (interfaces) are being tested. Tools?

Once our AI model is at the point we can begin testing we will use unit testing as stated in 5.1. We will also mock out our interfaces with unittest.mock in Python to test the interactions between the database and our machine learning model. In doing so we can test each interface separately to find and correct possible errors much faster.

5.3 INTEGRATION TESTING

What are the critical integration paths in your design? Justification for criticality may come from your requirements. How will they be tested? Tools?

A few of our critical integration paths in our design are as follows.

- Front-end Application to AI Model: The integration of these is critical because it's the main interface the healthcare professionals will interact with. It must be tested rigorously to ensure seamless function.
- AI Model to Database: After the model makes a prediction, it may need to retrieve or store information in the database. The integration between the model and the SQL database is critical for maintaining patient records and making predictions based on historical data.

- Training Pipeline: From model development, training, to evaluation, this path is critical as it affects the overall accuracy and reliability of the AI model. Ensuring that data flows correctly and the model updates are critical for learning efficiency and accuracy.

For testing these paths we will use automated integration testing with frameworks such as Selenium for front-end testing or TensorFlow's testing module. We will also be using GitLab's CI/CD to automatically build and test our application when changes are made.

5.4 SYSTEM TESTING

Describe system level testing strategy. What set of unit tests, interface tests, and integration tests suffice for system level testing? This should be closely tied to the requirements. Tools?

System testing is a high-level testing phase that involves evaluating the complete and integrated software system to ensure compliance with specified requirements. For us system testing will validate the end-to-end functionality, performance and user interface. Our system testing strategy will include functional testing, performance testing, usability testing, and compatibility testing. The tools we can use for these include load testing tools such as JMeter or Locust for performance testing. Automated testing suits such as Selenium for functional and usability testing of web interfaces.

5.5 REGRESSION TESTING

How are you ensuring that any new additions do not break the old functionality? What implemented critical features do you need to ensure they do not break? Is it driven by requirements? Tools?

Each time we make an addition we will repeat testing from our previous implementation afterwards to make sure we are still getting the same correct results. We do not have many different parts in our project so this will probably not be a big problem for us. The AI itself is self-contained so the only concern foreseen right now would be when connecting it to a website making sure it is correctly interacting with the model and creating the correct behavior. As we go through this process 'breaking' the model isn't really a concern, we just might need to troubleshoot interacting with it.

5.6 ACCEPTANCE TESTING

How will you demonstrate that the design requirements, both functional and non-functional are being met? How would you involve your client in the acceptance testing?

For functional requirements we will set up some use case scenarios for different types of users interacting with the implemented product that also define the desired outcome of each case. We will manually run each of these cases and check the behavior and results we get and check them against the success criteria. When we create the use cases we will show them to our client and double check that they follow their desired functionality of the final product. We will also demonstrate to our client the functionality by walking through some cases in front of them so they can see exactly how the product is working.

For non-functional design requirements we will collaborate with our client to establish the

expectations for performance of the system and then create scenarios where we test the specific non-functional requirements. This could require several different types of testing such as load testing and reliability testing among others. We will work closely with our client to determine what type of testing is most important here.

5.7 SECURITY TESTING (IF APPLICABLE)

We will be hosting our model on a website. The security of the website will be taken care of by the host we select. Once we get access to the data we will consult with our faculty advisor on if there are any additional security issues related to the data we need to worry about.

5.8 RESULTS

What are the results of your testing? How do they ensure compliance with the requirements? Include figures and tables to explain your testing process better. A summary narrative concluding that your design is as intended is useful.

We have not been able to test our design because we do not have access to the cancer data from the medical institutions. We are hoping that the implementation will meet the response time requirement and the accuracy requirement.