TESTING MACHINE LEARNING ALGORITHMS WITHOUT ORACLE

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Abstract here

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Introduction

Literature Review

- 2.1 Testing Without Oracles
- 2.2 Metamorphic Testing
- 2.3 Overview of Machine Learning Algorithms
- 2.4 Testing Machine Learning Programs

Proposed Work

3.1 Setting up the Test Environment

3.1.1 Docker

For replication of results. Image can be downloaded from dockerhub. Attached volume for persisting data.

3.1.2 Jupyter

3.1.3 Tensorflow

3.2 Selection of Implementations to Test

Work Plan

Bibliography

- [1] T. Y. Chen, F. C. Kuo, T. H. Tse, and Zhi Quan Zhou. Metamorphic testing and beyond. In Proceedings - 11th Annual International Workshop on Software Technology and Engineering Practice, STEP 2003, pages 94–100, 2004.
- [2] S Nakajima and H N Bui. Dataset Coverage for Testing Machine Learning Computer Programs. In 2016 23rd Asia-Pacific Software Engineering Conference (APSEC), pages 297–304, 2016.
- [3] Sergio Segura, Gordon Fraser, Ana B. Sanchez, and Antonio Ruiz-Cortes. A Survey on Metamorphic Testing. *IEEE Transactions on Software Engineering*, 42(9):805–824, 2016.
- [4] Elaine J. Weyuker. On testing non-testable programs. Computer Journal, 25(4):465–470, 1982.
- [5] Xiaoyuan Xie, Joshua Ho, Christian Murphy, Gail Kaiser, Baowen Xu, and Tsong Yueh Chen. Application of metamorphic testing to supervised classifiers. In Proceedings - International Conference on Quality Software, 2009.
- [6] Xiaoyuan Xie, Joshua W K Ho, Christian Murphy, Gail Kaiser, Baowen Xu, and Tsong Yueh Chen. Testing and Validating Machine Learning Classifiers by Metamorphic Testing. J. Syst. Softw., 84(4):544–558, apr 2011.