Predictive Modelling of Wine Quality using ML and DL techniques

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Abstract

The challenging and fascinating topic of wine quality prediction modeling is influenced by both chemical attributes and human perception. The possibility to increase wine quality prediction efficiency and accuracy with machine learning algorithms is what spurs this research. Quality control is critical in the wine sector, thus the concept sprang from the increased interest in automating and improving decision-making processes.

1. Introduction

Below follows the work we plan to do along with the timeline and the task distribution.

1.1. Related Work

Cortez, P., Cerdeira, A., Almeida, F., Matos, T., & Reis, J. (2009). *"Modeling wine preferences by data mining from physicochemical properties."* This study used various machine learning algorithms to predict wine preferences based on its physicochemical properties, which laid the foundation for many subsequent works in the field.

Fernandes, A., & Cardoso, J. S. (2019). *"A Comparative Study on Feature Selection in Wine Quality Prediction."* This paper compares different feature selection techniques to improve the accuracy of wine quality prediction models, highlighting the importance of selecting relevant features for better model performance.

Reddy, B., & Subramanian, R. (2022). *"Deep Learning Approaches for Wine Quality Prediction."* This recent work explores the application of deep learning models to predict wine quality, demonstrating that advanced neural networks can outperform traditional machine learning methods in some cases.

1.2. Timeline

A tentative timeline for this work is as follows:

- **Weeks 1-2:** Perform Exploratory Data Analysis (EDA) on the dataset to gain a deeper understanding of the problem.
- **Weeks 3-4:** Conduct a comprehensive review of past work on this problem, as well as similar problems in related fields.
- **Weeks 5-7:** Begin implementing initial models and analyzing the results. Aim to have preliminary results before the mid-semester exams.
- **Weeks 8-11:** Focus on fine-tuning the models and exploring more complex deep learning (DL) architectures to improve performance.

1.3. Individual Tasks

- **Arnav Agrawal:** Model Deployment, Evaluation and Fine-tuning
- **Aryan Singla:** Feature Engineering and Grid-Search
- **Harsh Rajput:** Data Processing, Model Deployment and Fine-tuning
- **Kshitij Gupta:** Data Preprocessing, Front-end and Deployment

1.4. Outcome

Post this work, we hope to be able to read documentation and implement code of models with more comfort. Also, we hope to learn practical skills like pre-processing, fine-tuning and data and result visualisation whilst using Maching Learning tools and libraries such as WandDB, Numpy, PyTorch and Scikit-Learn!