Related Works – SVM Classifier & GLCM

The SVM is a Machine Learning algorithm that can do both Classification and Regression problems. SVM operates by finding a decision boundary (a street) and works to make the decisions boundary as wide as possible (make the street as wide as possible), whilst simultaneously reducing the amount of amount of Margin Violations (data points that violate the decision boundary) [1]. This algorithm can identify decision boundaries for all dimensions of data, however, for our dataset we will be using a specific version of SVM, called SVM Classifier, which is better suited for classifying data.

SVM Classifier is very similar in operation to SVM, it analyzes the data points given, and finds hyperplanes (decision boundaries) that separate the different classes that are present within the data [2]. After this, we can apply kernels which provide a way to format the data allowing for linear separation. This is because the decision boundaries are lines or planes existing in 2D or 4D space, respectively [3]. Kernels may also increase accuracy based on the newly shaped data. Using a kernel may provide better accuracy for our dataset, since it includes over 2000 images that will each be of size 500 x 500 px.

Preprocessing the images will prove advantageous to increasing the model's performance as well as resilience to over/underfitting. To this end, many researchers suggest using GLCM to perform Feature Extraction. Gray Level Co-occurrence Matrix, or GLCM was the technique used in both papers conducting analyses that were ultimately fed into the SVM Classifier algorithm [4, 5]. GLCM operates by transforming the given dataset of images into grayscale via intensity. It measures the different pixel brightness values of an image and yields an output that is grayscale, representing the original image [5]. GLCM performs a calculation using a second order statistical calculation that considers the relationship between the two-pixel groups of gray images [4]. Using GLCM may provide a better sense of Feature Engineering, rather than just relying on the resized images, which is why these papers were selected.

Feeding the SVM Classifier with the GLCM Feature Engineered images seemed to improve the model's performance for both papers [4, 5]. Both papers provided the steps which they followed to achieve the results. Looking at both processes, I believe that I can model my approach similarly. I will most likely add an RBF kernel like that of [5] to increase model performance and statistical measures: accuracy, precision, recall, and F1 score.

1. https://www.geeksforgeeks.org/support-vector-machine-algorithm/
2. https://towardsdatascience.com/support-vector-machine-introduction-to-machine-learning-algorithms-945a555fca57
3. https://holypython.com/svm/support-vector-machine-pros-cons/
4. S. Marianingsih and F. Utaminingrum, "Comparison of Support Vector Machine Classifier and Naïve Bayes Classifier on Road Surface Type Classification," 2018 International Conference on Sustainable Information Engineering and Technology (SIET), Malang, Indonesia, 2018, pp. 58-54, doi: 10.1109/SIET.2018.8694114.
5. G. Karthick and R. Harikumar, "Comparative performance analysis of Naive Bayes and SVM classifier for oral X-ray images," 2017 5th International Conference on Electronics and Communication Systems (ICECS), Coimbatore, India, 2017, pp. 88-92, doi: 10.1109/ECS.2017.8067854.