more widely and evenly distributed spectrum than other non-notch data. However, it is important to mention that due to nonlinear feature projection of the RBF-SVM, result interpretation becomes challenging and is not always easily possible.

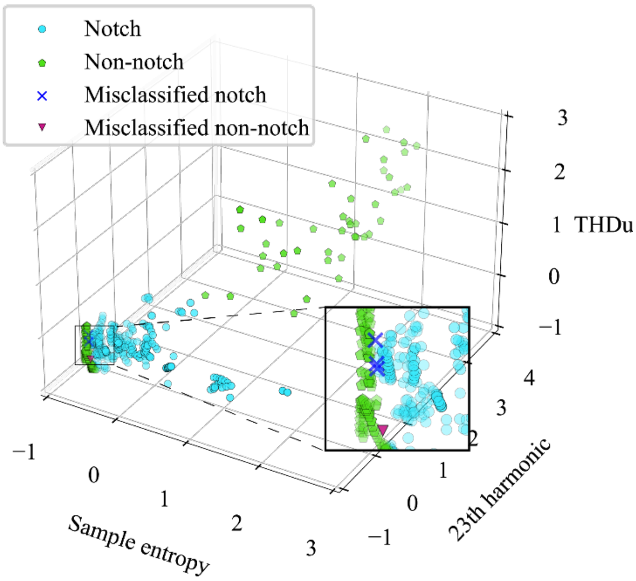

Fig. 4. Visualization of the feature space

5. Conclusion

This paper proposes a comprehensive framework for voltage notch analysis and automatic detection based on nonlinear support vector machine classifier. A comprehensive simulation framework for notching phenomena resulted in deeper understanding of factors influencing notch depth and area, which are the most common parameters to characterize notches. Additionally, as result of simulation, it was possible to increase waveform data diversity build a well generalized classification model. According to results of the method performance, the feature extraction based on both domain knowledge and time-series properties provides several advantages such as deeper understanding the data properties of PQDs, reduction the data size and computation time over the conventional approaches. In addition, an efficient feature selection algorithm such as decision tree can highly reduce the feature vectors, decreasing the risk of overfitting and saving considerable memory space and computational time. Furthermore, the constructed classifier is able to classify notch and non-notch waveforms with high accuracy of 99.2%.

In future work, several potential improvements can be done for the notch detection and classification. For example, localization of notching source and application of a multi-class support vector machine to a more diverse database of power quality disturbances.

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