Machine learning based modeling framework to relate biomass tissue properties with handling and conversion performances

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Summary

The proposed project is aimed at developing a robust machine learning-modeling framework to relate biomass tissue properties with feedstock handling and conversion performances using machine learning techniques such as Artificial Neural Network (ANN). To rapidly detect and measure biomass tissue properties, a novel near infrared spectroscopy-HyperSpectral Imaging (HSI) system will be developed for corn stover and Southern Pine Forest Residues, which can be deployed in-field/in-line process measurement. Manual/mechanically separated tissue fractions will be subjected to grinding experiments to predict grinding performances, while the mechanical and bulk flow properties of ground tissue fractions will be measured to predict powder flow classifications. Artificial neural network (ANN) will be developed to link chemical properties with conversion yields, while physical and mechanical properties of ground powders will be linked to bulk flow performances. The developed ANN models will guide selective preprocessing operations to produce highly flowable and conversion specific feedstock for smooth operation of a biorefinery. They can also be used to design modern biomass depot targeted to manufacture uniform and standardized feedstock for a specific conversion, while developing optimal strategies to monitor, manage and control powder flowability during handling and storage and thus the improved operational reliability of a biorefinery. The successful completion of the project will not only meet the BETO's Feedstock-Conversion Interface goals, but also deliver science-based strategies to preprocess biomass at the tissue level to unlock the feedstock-conversion interface challenges and flowability issues for a biorefinery.