



# Automated SC Management Using Machine-Learning-based Tariff Classification and Optimized International Trade Compliance

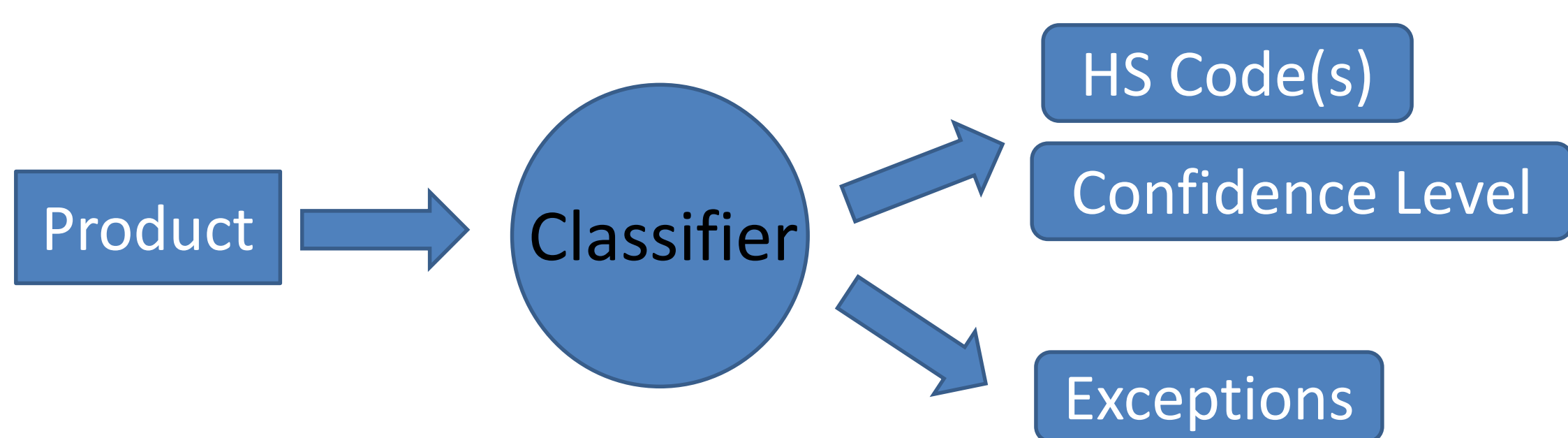
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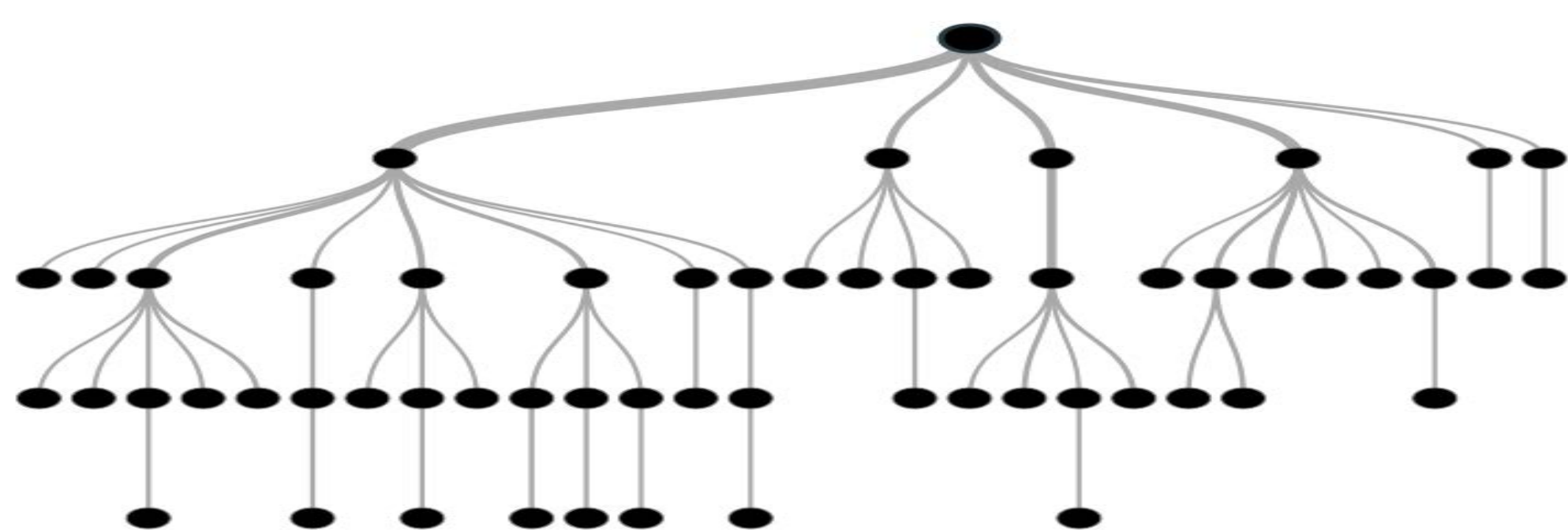
## 1. Research Project & Axia Theme

The product to be imported or exported goes through the process of customs clearance. To make this task standardized, every product is assigned a Harmonized Tariff Schedule (HTS or, in short HS) code. Correct identification of HS code for a product is advantageous, as it reduces expenditure of extra time and money. It also maximizes the benefits, if any, of discounts on tariff for products with particular HS codes based on trade agreements between importing and exporting nations. The aim of this research project is to develop an automated classification system to assign the HS code to a product. The workflow of the project will be as follows

- Study the HS Code tree structure and WCO Explanatory notes (available on Customs info website) and develop a structured reference database.
- Preprocess existing data.
- Use the processed database and reference database for feature generation and extraction.
- Train a machine-learning-based classifier implementing a decision tree algorithm and perform N-fold validation using the training data generated above
- The output of the automated classifier will also provide a “confidence level” of the assigned HS code.
- It should also flag exceptions.



Random-Forest-based Classifier



### Project theme:

Create an automated classification system to assign a Harmonized Tariff Schedule (HTS or HS) Code to a product.

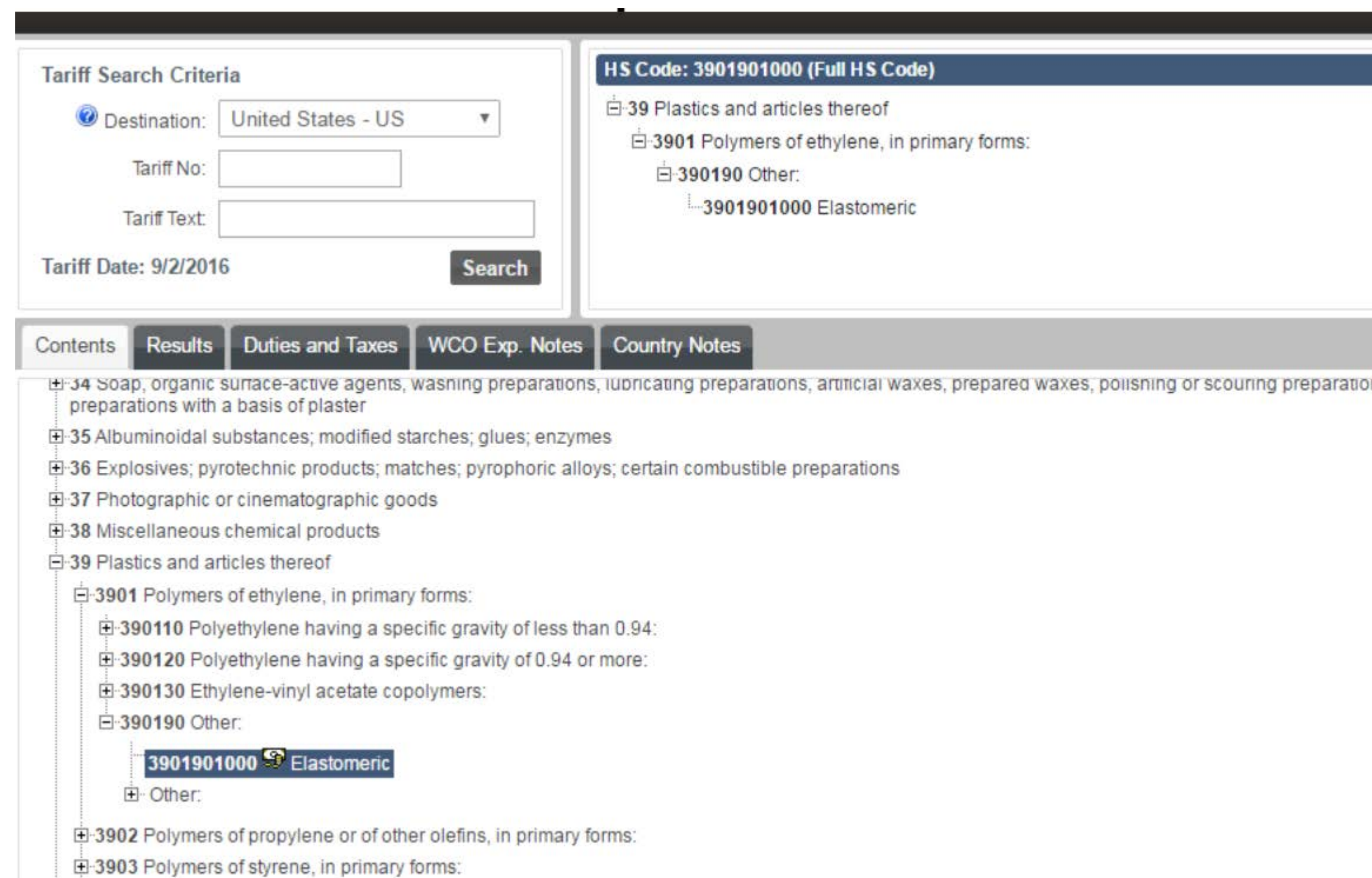
## 2. Value to Be Created

- The team plans to develop automated procedures of handling tariff and shipment data for a (i) reduced time of work process completion, (ii) reduced cost of operation, and (iii) adherence to international trade compliance.
- The research is expected to produce pragmatic and efficient solutions, compared to manual accomplishment of the above tasks.
- The proposed approach is also expected to produce valuable insights about critical interactions among various work process parameters for compliant and optimized solutions.
- Critical parameter interactions on non-compliant work processes will also be identified for easy detection of such work processes in an automatic manner.

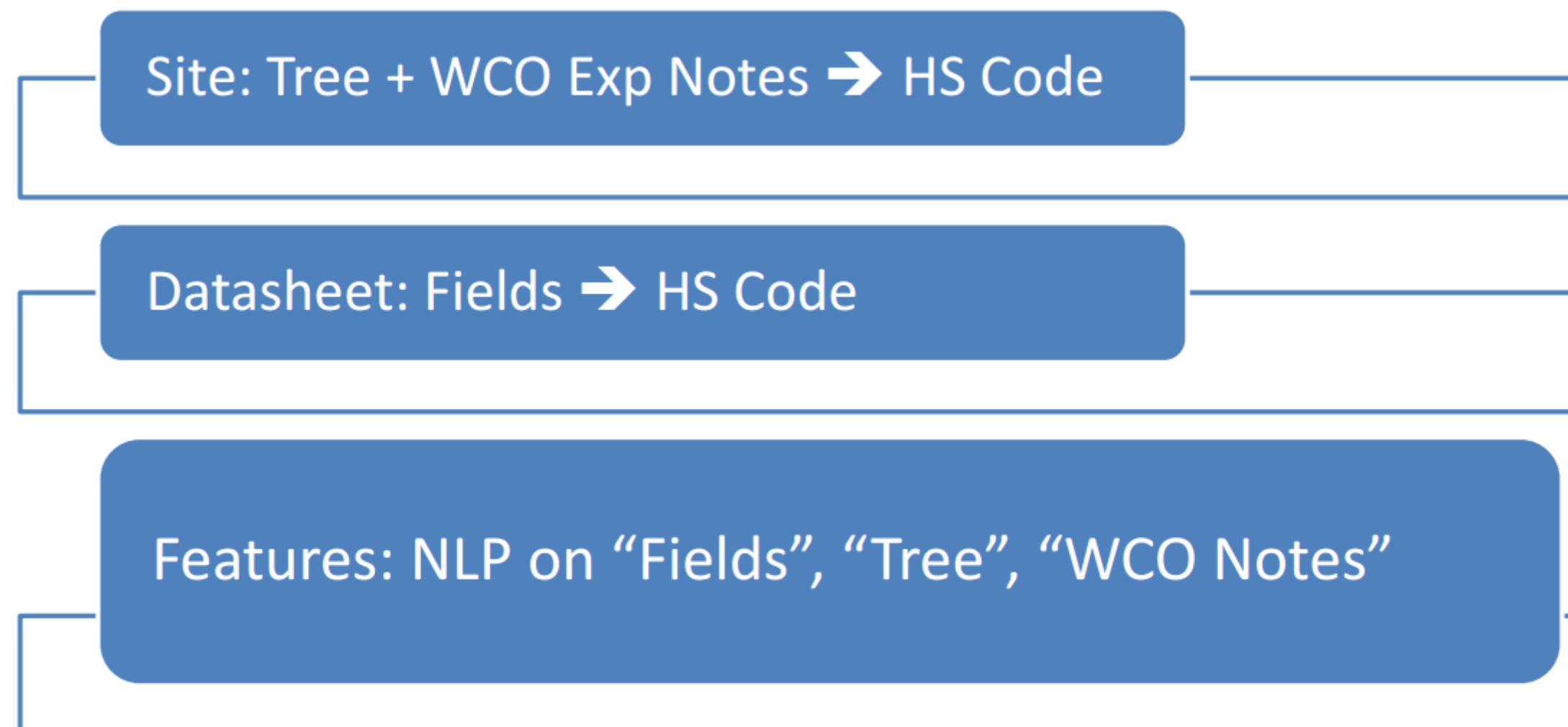
The project started on 16 August 2016 and will continue for one year

## 3. Results/Future Directions

### Manual Classification: HS Code and WCO Explanatory Notes



### Feature Generation



## 4. Project Plan

**Milestone 1:** A rule-based system will be developed to assign a HS code to a product that will match the WCO nomenclature system as closely as possible. MSU researchers will identify critical features of the products (properties and specifications of products) by using a part of these products and their available HS codes and develop a trained decision-tree-based classification methodology which is able to correctly associate the remaining products with their HS codes. Thereafter, the trained decision-tree will be used to validate classification of 1,000 other products that were not used in either training or testing processes.

**Milestone 2:** Developed decision trees will be analyzed to identify critical bottlenecks in the feature identification process involving various manufacturing processes and product specification processes, so that the entire tariff classification process can be optimized for minimal effort and computation time.

**Milestone 3:** Further improvements of the tariff classification process can be made by gathering past supply-chain and product flow information (such as, HS codes, tariffs and duties charged, delivery time at each intermediate country and time to final destination).