# Advanced Active Learning Methods for Robust Classification of Multi-Source Remotely Sensed Data

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Objective

- Improve the use of land cover data by developing an advanced framework for robust classification using multi-source datasets:
- Develop, validate and optimize a generalized multi-kernel, active learning (MKL-AL) pattern recognition framework for multi-source data fusion.
- Develop both single- and ensemble-classifier versions (MKL-AL and Ensemble-MKL-AL) of the system.
- Utilize multi-source remotely sensed and in situ data to create land-cover classification and perform accuracy assessment with available labeled data; utilize first results to query new samples that, if inducted into the training of the system, will significantly improve classification performance and accuracy.
- Work will be performed in collaboration with the NASA Earth Science Division's Carbon Cycle and Ecosystems focus area.
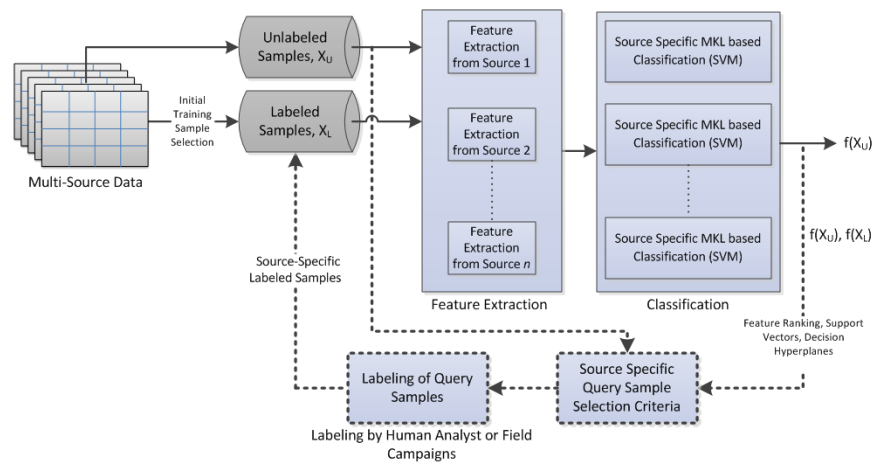
Proposed Ensemble Multi-Kernel Active Learning Algorithm

Accomplishments

- Developed both single- and ensemble-classifier versions (MKL-AL and Ensemble-MKL-AL) of the system.
- Incorporated the multi-kernel Support Vector Machine (SVM) into an ensemble multi-source-classification system.
- Completed the multi-view active learning component of the system and its integration with Hierarchical Segmentation (HSEG). HSEG extended to include:
  - segmented boundary information to mitigate the impact of edge anomalies exhibited at the boundaries of regions.
  - pruning the segmentation tree, and inclusion of multiscale spatial information in the multi-source environment.
- Validated the new methods using a suite of multispectral, hyperspectral, and airborne LIDAR data collect over a well characterized field site.
- Framework implemented and demonstrated on the Purdue cloud computing platform.

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TRL_{in} = 2 TRL_{out} = 4