

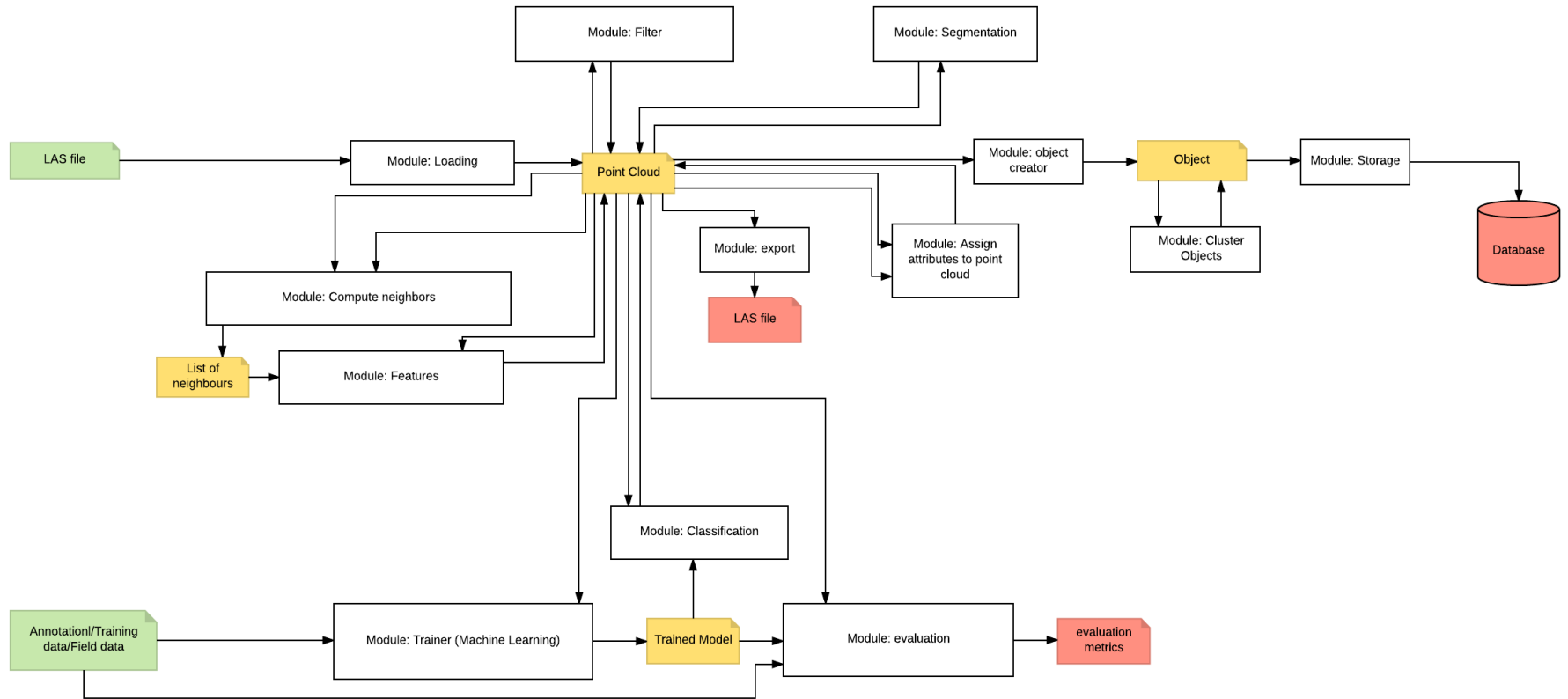
eEcoLiDAR – NLeSc Infrastructure V2.2

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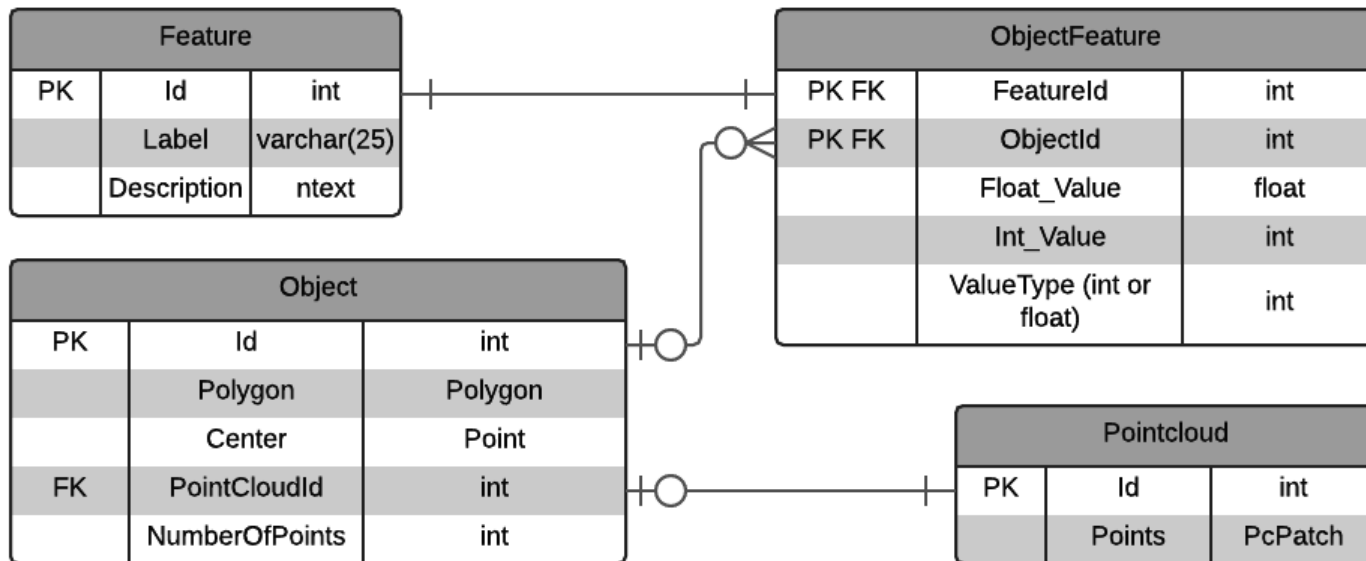
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Infrastructure WorkFlow V2.2



DataBase schema



Module: Loading

Input: LAS file

Output: PointCloud

Description: load LAS file into memory and output it as a point cloud, either in an intermediate file format or just keep it in a data structure in memory.

Library: liblas, <https://github.com/laspy/laspy>

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Module: Filter

Input: PointCloud

Output: PointCloud (filtered)

Description: takes a point cloud and returns another point cloud that could either be a sample of the original or it could be some other pattern of points (for example a grid).

Types of Filters:

- Point cloud: Height (z), Echo info, Point by Point
- Shape: Polygon, Rectangle, Voxel, Grid search
- Subsample defined by Feature/Classification: height difference, nDSM height, veg/non-veg,...

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Module: compute neighbors

Input: environment PointCloud, targets PointCloud

Output: list of neighbors

Description: For each of the targets, the module computes the neighbors in the environment.

If we want to compute the neighbors for all points, the target point cloud will be identical to the environment. If we would want to rasterize the environment, the target would contain a grid of points.

Options: Cylindrical (unlimited-2D, limited – 2.5D), Spherical (3D)

Software: Numpy, Scipy, pyflann, GDAL + GRASS GIS,
<http://scikit-learn.org/stable/modules/neighbors.html>

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Module: Features

Input: list of neighbors, target PointCloud

Output: PointCloud

Description: computes features to each neighborhood and assigns them to the target point cloud

Options:

- Normals, Eigenvalues, cov matrix
- Statistics (min, max, median, std, count...)
- EchoRatio
- Allometric derived features (biomass, stem volume...)

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Module: Trainer (Machine Learning)

Input: Training Data/Field Data, PointCloud

Output: Trained Model

Description: this module takes annotations, and target point cloud (already assigned with features) and outputs a trained model to be used as input for classification

Options: Random Forest, SVM, Markov random fields, Conditional random fields, Adaboost, artificial neural networks (ANN)

Software: <http://scikit-learn.org/.../sklearn.ensemble.RandomForestClassifier.html>



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Module: evaluation

Input: Annotations, Trained Model, PointCloud

Output: Evaluation metrics

Description: Tests a model on a test set and outputs the relevant metrics. These need to be communicated to the user somehow. This could be done by printing it to a file or to the screen for example.

Options: confusion matrix, f-measure, accuracy

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Module: Classification

Input: PointCloud, Trained Model

Output: PointCloud

Description: Uses the trained model to classify the target point cloud and assign the class to the point cloud (so the output is a classified pointcloud). The class is added as a feature to the point cloud.

Options: Trees, Forest, Edges, Bushes, Urban, Road, etc...

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Module: Assign attributes to point cloud

Input: `classified PointCloud`, `unclassified pointcloud`

Output: `PointCloud`

Description: Uses the classified point cloud to assign classes to the unclassified point cloud (using k-Nearest Neighbors for example).

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Module: Export

Input: pointcloud

Output: LAS file

Description: at any point in the workflow exports the enriched point cloud into a LAS file

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Module: Segmentation

Input: PointCloud

Output: list of pointclouds

Description: Segments or clusters the point cloud into several segments which will be returned as separate point clouds.

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Module: Object creator

Input: PointCloud

Output: Object

Description: takes the point cloud (including all the relevant features/classes) and summarizes it into an Object.

It will also calculate summary statistics, including polygons, saved as Object features based on its points.

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Module: Cluster Objects

Input: Object
Output: Object

Description: Clusters objects based on their common feature/s, and forms new objects

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Module: Storage

Input: Object

Description: Store the objects with their Features and summary statistics

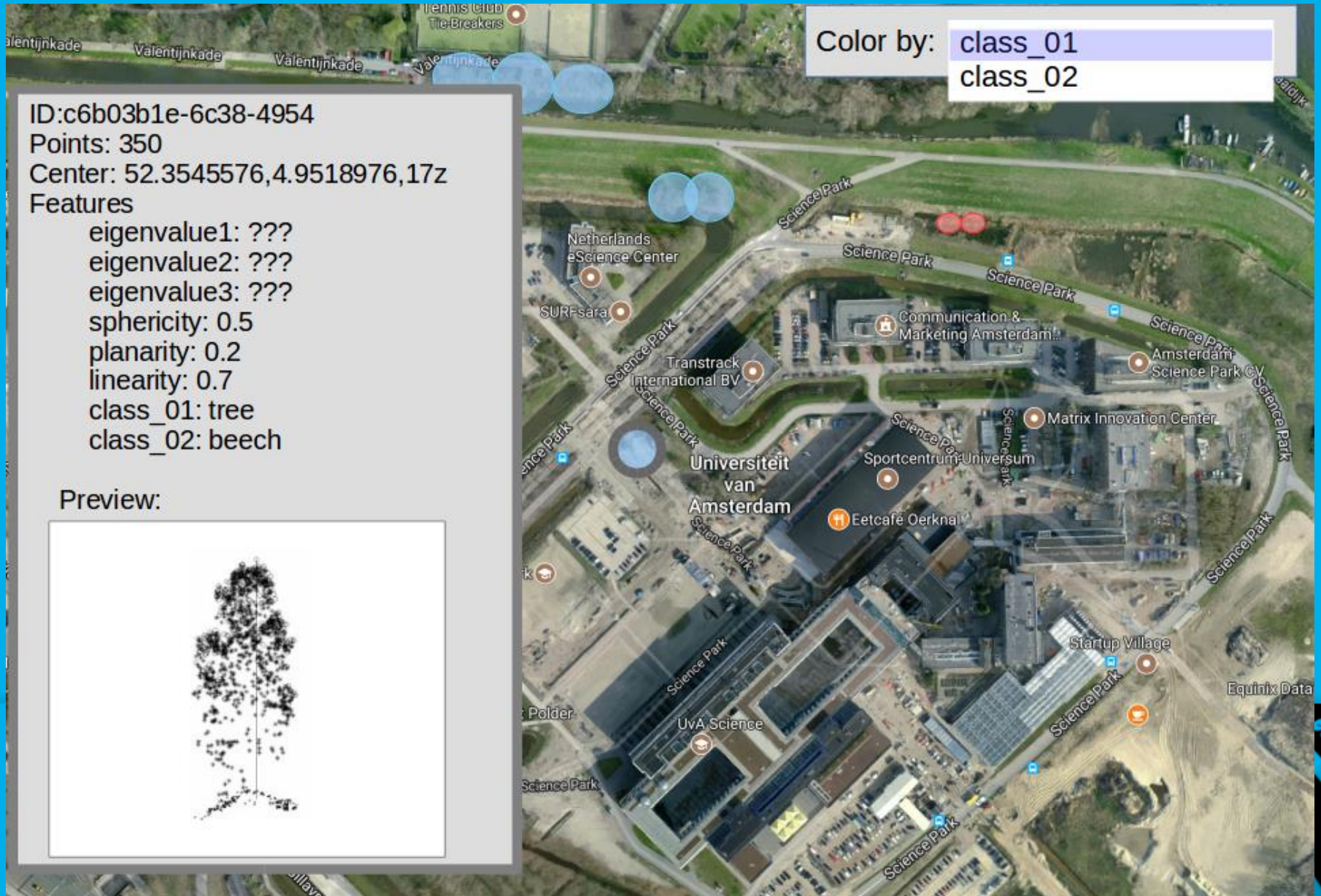
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Browser



Optional Modules/additions

Storage – Sentinel data,
Climate, Birds

User administration

Storage – LiDAR data

Suggestions?

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