Semantic Analysis of ALS data in urban areas using Conditonal Random Fields

The proposed method for 3D scene analysis relies on a generic selection of individual neighborhoods based on the k-nearest neighbors (knn) and the eigenentropy for the extraction of various locality-based radiometric and geometric features at the point level and later conducts the contextual classification using a classifier based on Conditional Random Field.

Features:

- 3D geometric features:
  - eigenvalue based features (3D structure tensor)
  - height features including the normalized height
  - point density
  - verticality
  - radius of the local neighborhood
- 2D geometric features based on 2D projection of the point cloud on to the horizontal plane
  - eigenvalue based features (2D structure tensor)
  - point density
  - radius of the local neighborhood
  - 2D accumulation map
- Intensity value from the LiDAR point cloud

We used a Conditional Random Field for the semantical labeling at the point level, which used a Random Forest classifier for generating the unary potentials and a variety of the contrast-sensitive Potts models for generating the pairwise potentials.

Authors: Moritz Steinsiek, Przemyslaw Polewski, Wei Yao