# 能量函数



where L is a given set of labels (planes) and d(.) is an indicator function. Let P represent a set of data points, the multiple labeling task is to assign a point p P, a label lp  L such that the labeling L minimizes the energy E(L), where lp is the set of labels appearing in L and N is an assumed neighborhood for data points. Three energy terms are considered in the energy formula.

The optimize target is to find a set of labels for each points.

D: measures the discrepancy between data points and labels. It is the sum of the distances of points to their assigned labels. the key issue is to find a function to describe points with the same label, and define a proper distance function.

S: The smooth cost term measures the label inconsistency between neighboring points. It is the sum of

weight wpq of each pair of neighboring points p and q that are

assigned to different labels.

C: The label cost term measures the number of labels appearing in L.

# workflow

## algorithm 1

用binary Graph cut

用于downtown，高楼

(1) isolate removing

(2) voxelization and set up neighbourhood

(3) feature extraction for each voxel

(3.1) unique features

(3.1.1) eigenvalue / eigenvector

计算协方差矩阵



Eigen::Vector4f xyz\_centroid\_;

EIGEN\_ALIGN16 Eigen::Matrix3f covariance\_matrix\_;

computeMeanAndCovarianceMatrix (\*org\_pts, indices, covariance\_matrix\_, xyz\_centroid\_);

Eigen::EigenSolver<Eigen::Matrix3f> es(covariance\_matrix\_);

Eigen::Matrix3f D = es.pseudoEigenvalueMatrix();

Eigen::Matrix3f V = es.pseudoEigenvectors();

调整法线方向

按单位向量n0(0,0,1)进行调整



(3.2) neighbour-relevant feature

1. neighbourhood connectivity

(5) energy function

Data term:





h0为最小建筑物高度，α=0.5，控制逼近度

Smooth term:

Surface flatness



正定矩阵的性质，特征值非负

有去除植被的潜力，暂时没想到度量函数

Height difference between voxels

对L型进行惩罚，区分凸凹性，即T型和L型

夹角

0~180，带方向

**余弦相似度**([cosine similarity](http://baidu.pigproxy.cn/browse.php?u=ef35e132b0c6fa0fcOi8vZW4ud2lraXBlZGlhLm9yZy93aWtpL0Nvc2luZV9zaW1pbGFyaXR5&b=1))-**CosineDistanceMeasure**

余弦相似度用向量空间中两个向量夹角的余弦值作为衡量两个个体间差异的大小。相比距离度量，余弦相似度更加注重两个向量在方向上的差异，而非距离或长度上。

优点：不受坐标轴旋转，放大缩小的影响。

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**5.Jaccard系数**

Jaccard系数主要用于计算符号度量或布尔值度量的个体间的相似度，因为个体的特征属性都是由符号度量或者布尔值标识，因此无法衡量差异具体值的大小，只能获得“是否相同”这个结果，所以Jaccard系数只关心个体间共同具有的特征是否一致这个问题。如果比较X与Y的Jaccard相似系数，只比较xn和yn中相同的个数，公式如下：

IMG_256

2017.04.24简单的光滑项设计



凹凸性惩罚：











## 参数分析

### Data term

 越大对低矮点的抑制越明显

|  |  |
| --- | --- |
|  |  |
| 0.1 |  |
| 0.5 |  |
| 2 |  |
| 5 |  |

最小建筑物高度

数据项重新设计：

### Algorithm flow

分层聚类，聚类中心作为种子点

初始聚类过滤，去除树木和杆状物

## algorithm 2

voxelization

从高到低，选取一个voxel(非墙面)