# Report for the week from 9/24/2017 to 10/01/2017

## Last week:

### - What where your goals?

1.Using the software Cloud Compare to demonstrate, downsample, compare and manually register the point clouds.

2.Read VLAD paper

Aggregating Local Image Descriptors into Compact Codes

Review the Fisher Vector, BOW, GMM….

3.Learn CV at PolyU.

About Harris. SIFT, LBP,HOG

Inspiration: apply these operators from 2D to 3D

Read the following paper

1. 一种基于2D 和3D SIFT 特征级融合的一般物体识别算法

Another way to select keypoints: 27+27+26=80 neighbourhood extremes of DOG scale space

(2) Harris 3D: a robust extension of the Harris operator for interest point detection on 3D meshes

(3)An adaptive local binary pattern for 3D hand tracking (3DLBP)

Meanshift can also be used to find keypoints.

Other inspiration: these methods are applied directly to the raw point cloud.

We may voxelize the pointcloud at first and then these operators may have better results.

Voxel /3D Pixel /2D

For BDS, we randomly extract k pairs of bins and compare them to get the binary code. Can we use other ways like LBP’s idea and may improve its descriptive power?

4.Read papers on object segmentation and classification

1. VEHICLE RECOGNITION IN AERIAL LIDAR POINT CLOUD BASED ON DYNAMIC TIME WARPING

Use DTW to evaluate the similarity between two profiles.

Shortcomings: It uses a lot of prior knowledge and is only tested on a single dataset.

(2) Airborne LiDAR Points Classification Based on Tensor Sparse Representation

Classification Algorithm: SPC with tensor

### - What are your key results?

1.VLAD (Compared to BOW and Fisher Vector)

T local descriptor vector(D dimensions)🡪 K-means(using EM algorithm)🡪K centroids (K<<T)🡪  we get a global vector(K\*D dimensions)

🡪two normalization (power normalization and L2 normalization[may be easily represented as cosine similarity for further comparing])🡪global vector V’

BOW: K-means and then use the histogram

FV: use GMM(also use EM to iterate) instead of K-means, so FV is VLAD with probability. It means that it’s dimension is 3 times of VLAD’s and it may be more general than VLAD.

So why do we choose VLAD rather than FV?

2. different common classification methods

Supervised: Naïve Bayes, decision tree, random forests, sparse representation, KNN, linear regression, logistic regression, SVM, Neural Network

Non-supervised: K-means, GMM

3. Classification flowchart

Raw Point Cloud(already registered)🡪pre-procession(downsample)🡪filiter the ground-points, segment the wall points(using some threshold determined by prior knowledge and perform region growing)🡪object segmentation(using geometric elements fitting[Ransac, Hough transform or Energy minimization by Graph Cut] or region growing with prior threshold)🡪set up some unique description of the object and form a vector(for example, detect keypoints of the object and aggregate the local descriptors of the keypoints to get a global vector)🡪[not necessary]define the certain similarity evaluation(for further classification, the loss function)🡪perform classification using methods in 2.

How to assess the classification: TP FP FN TN P,N the model think it’s true or false T,F the model’s decision is true or false

Accuracy= TP/(TP+FP) Recall=TP/(TP+FN)

## This week:

### - What are your goals for this week?

Read more paper about global registeration.

Try some common algorithm and analyze them by Cloud Compare.

### - What are you currently working on?

Read papers about 3D Harris.

Review Linear Algebra. Learn CV(2D).

### - What are your stumbling blocks?

C++ complex project programming ability

How to do experiment and test the method? Which test set can I use and how to test the state-of-art method on the test set?

## Longer term (semester):

### What are you three top objectives for this semester? How do you measure them?

1. Design a throughout flow path on global consistent registration
2. Perform the algorithm on some test database, analyze them and look for the optimal parameter
3. Try to apply some machine learning algorithm to indexing point cloud global similarity and outperform the existing method
4. Write a paper on this topic