

RT Systems Lab

**Weekly Report number (2)**



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# This Week's Tasks

* Running on a full room (360 degrees)
* Testing lower fps rates.
* Testing different height approximation functions.
* Testing different maximal heights
* Moving to Real Time setup.

# Tasks Done

## Running on full room

We started by writing the path in python, which we done using the existing wrappers Bar offered us. We got 6 h264 files, 6 csv height files, and 6 npy files. To ease our mission, we updated the python code to automatically convert whole .npy files directory into a new directory of the files with the same names. Next up, we wrote the main function as it follows:

void continuize(vector<double>& heights)

{

int i = 1, j = 0;

while (i < heights.size())

{

while (i < heights.size() && heights[i] == heights[j]) i++;

if (i == heights.size()) break;

double d = heights[i] - heights[j];

double diff = d / (i - j);

for (int k = j + 1; k < i;k++)

heights[k] = heights[k - 1] + diff;

j = i;

}

}

vector<Eigen::Vector3d> extractPoints(string path, string heights\_path,int angle)

{

auto motionVectors = importMV(path);

CSVFile height\_file(heights\_path, NUM\_FRM);

height\_file.openFile();

auto heights = height\_file.readColumn();

auto centers = getCenters();

Analyzer analyzer(fx, fy, cx, cy);

vector<Eigen::Vector3d> points;

// continuize the heights function.

continuize(heights);

differences(heights);

for (int i = 0;i < motionVectors.size();i++)

{

vector<Eigen::Vector3d> tmp = analyzer.mapPoints(centers, motionVectors[i], heights[i]);

points.insert(points.end(), tmp.begin(), tmp.end());

}

Analyzer::rotatePoints(points,angle);

return points;

}

void showTD(vector<Eigen::Vector3d> points)

{

string window\_name = "Room Map";

PointDisplayer displayer(window\_name);

displayer.topDownView(points);

}

int BuildTDView(vector<string> mvFiles, vector<string> heightFiles)

{

if (mvFiles.size() != heightFiles.size()) throw "Invalid sizes in BuildTDView";

vector<Eigen::Vector3d> points;

for (int i = 0;i < mvFiles.size();i++)

{

auto tmp = extractPoints(mvFiles[i], heightFiles[i], 60\*i);

std::cout << "Processing Angle : " << 60 \* i << std::endl;

points.insert(points.end(), tmp.begin(), tmp.end());

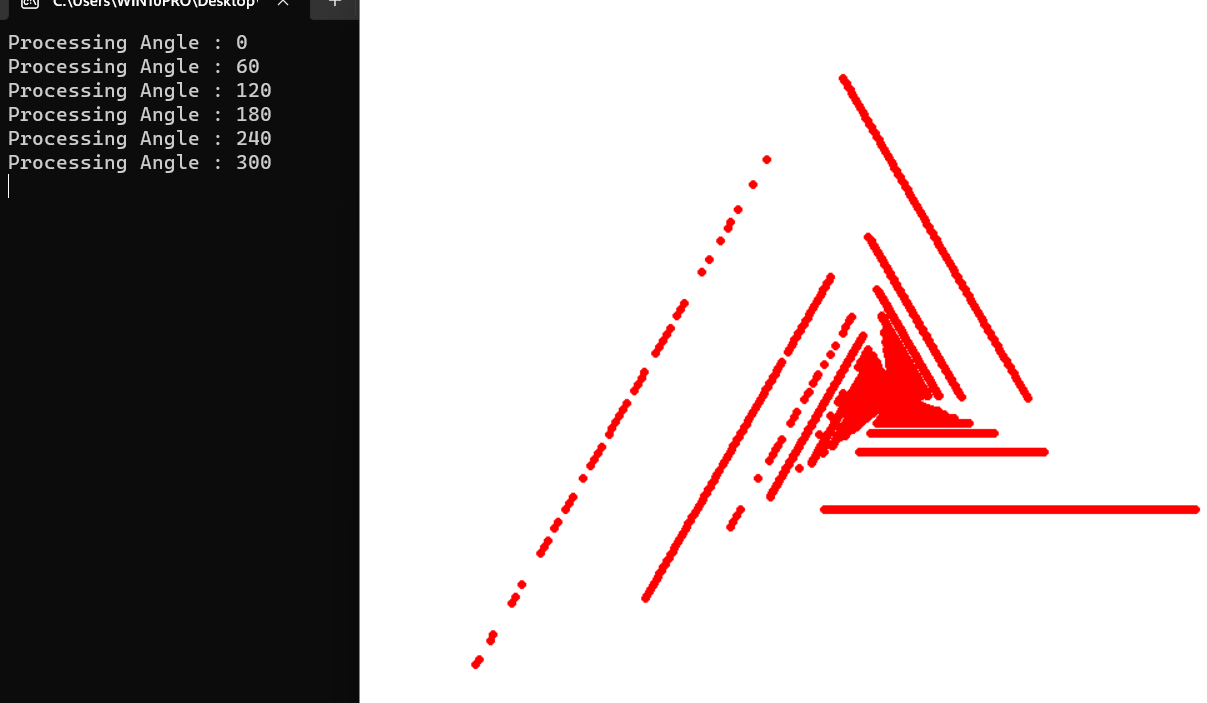
}

showTD(points);

return 0;

}

We got the following results:



The results seemed incorrect since we expect them to be round, so we decided to recheck our code. We ran on checks sanity check:

vector<Eigen::Vector2d> motionVectors {

Eigen::Vector2d(0,1), Eigen::Vector2d(0,1),

Eigen::Vector2d(0,2), Eigen::Vector2d(0,4)

};

double height = 2;

vector<Eigen::Vector2d> centers{

Eigen::Vector2d(1,0), Eigen::Vector2d(0,1),

Eigen::Vector2d(1,1), Eigen::Vector2d(0,0)};

We ran the code and got the expected points:



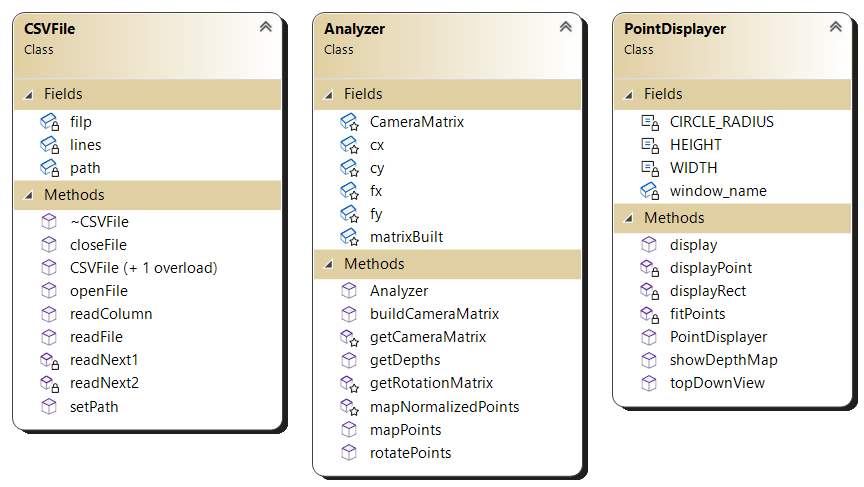
We realized the data is well processed, but we don't know the top-down view shape, meaning that it's not a useful way to check if we're doing the right calculations, so we implemented depth map, and got the following results (yellow dashed lines are lines we added to indicate the emphasized outline).

We must mention that we used 5 fps rate, and moved up to 90 cm (height range of 70-160 cm), which allowed better data values distribution (less 0 motion vectors), and did give better results.

## Choosing Optimal Height Function

We looked at the height as a function of time, and got the following function:

Which indicates that the velocity over time is almost constant, meaning that the best approximation would be .

At the end, we are showing a class diagram of our project for futuristic indications.

# Next Week's Tasks

* Debugging the code
* Matching between two representations of the same point in two different frames
* Making the code more elegant
* Making the code more efficient