

//Final Project

BOUNDING BOX DIMENSIONS DETECTION

COMPUTER VISION

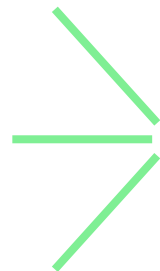
Detection of box dimensions based on pointclouds

André Fernandes, 97977

Álvaro Freixo, 93116

VC '22

Universidade de Aveiro



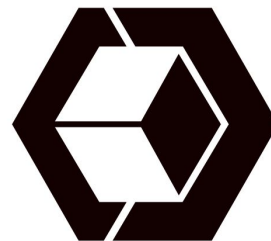
Objectives

- Estimation of box dimensions
- Integrate Visionary-s (FFonseca) and Xbox Kinect (if possible)
- Visual identification of various dimensions of boxes
 - One, more units
 - Static, moving
 - Pre-recorded, live

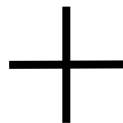


Tecnologies

- Ransac - plane regression (1 box)
- DBSCAN - plane regression (multi box)
- Aligned Bounding Box
- Oriented Bouding Box

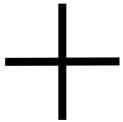
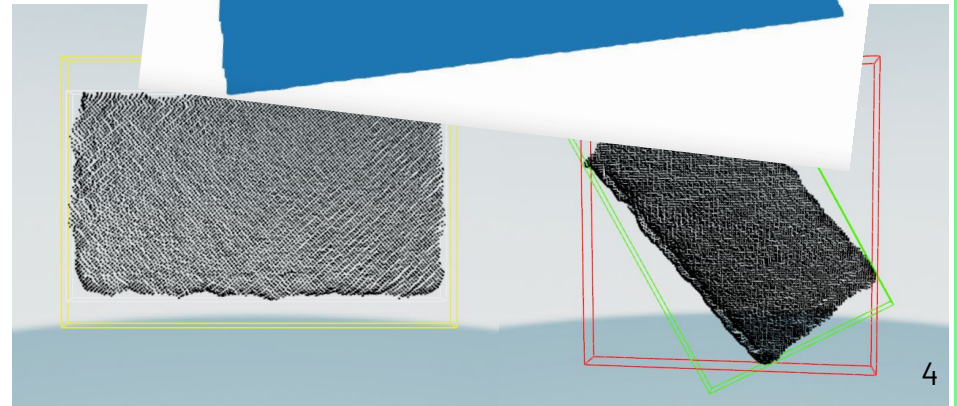
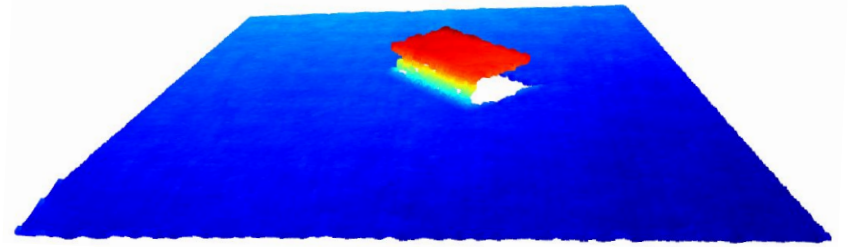


OPEN3D

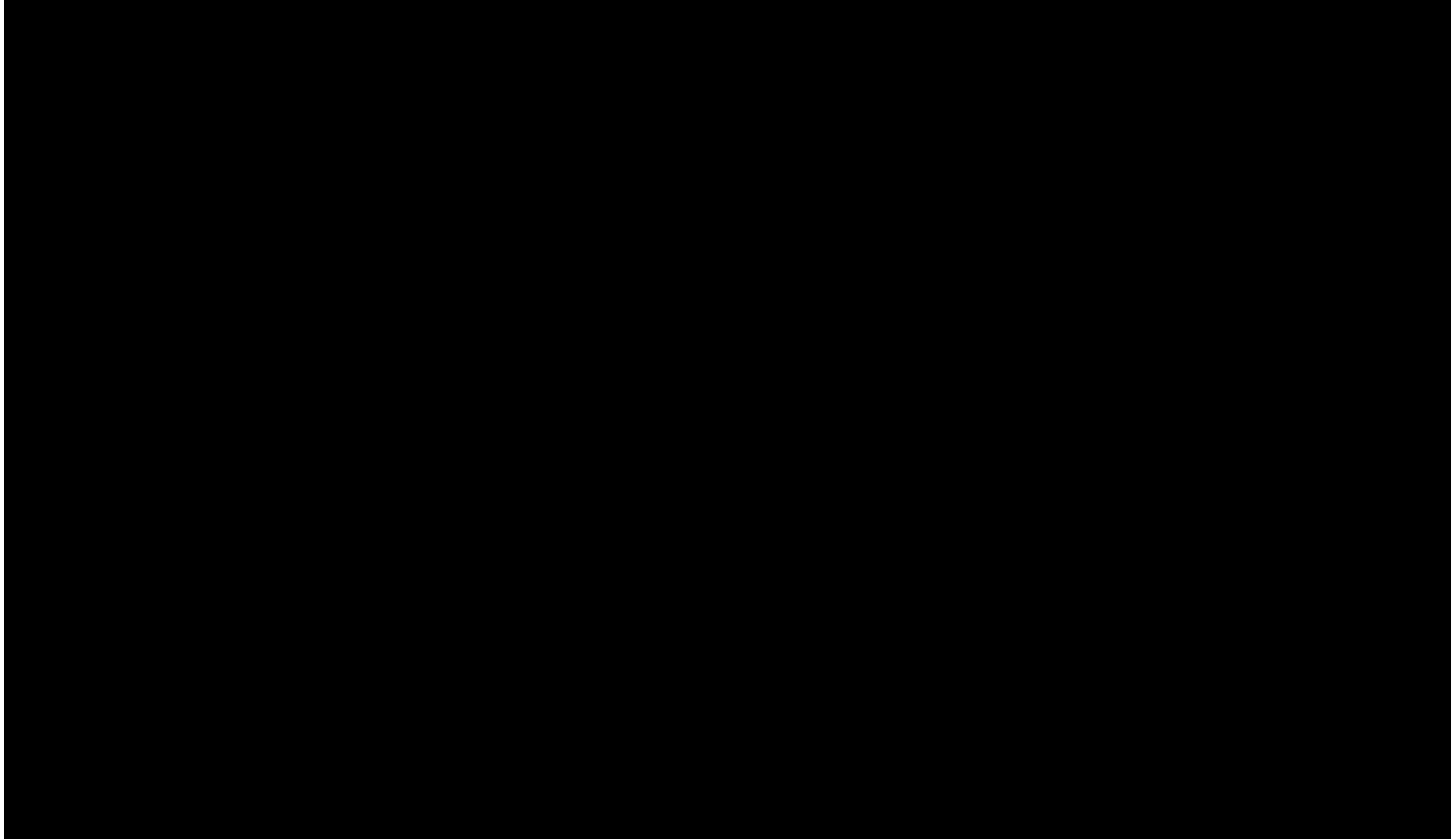


What we made?

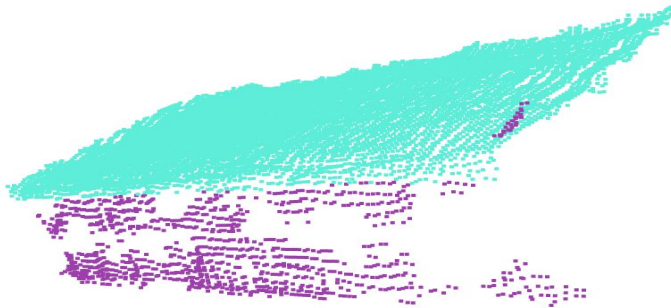
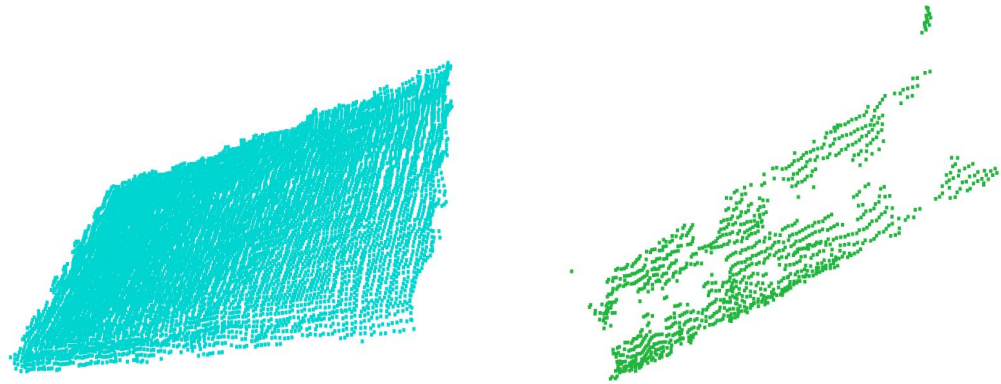
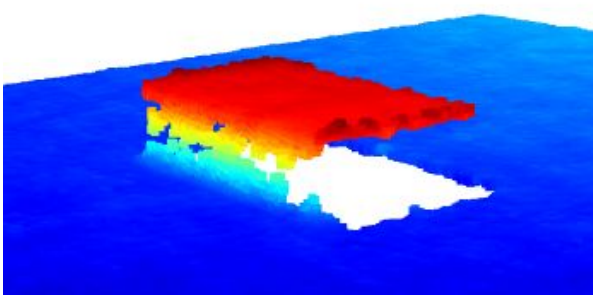
- Estimation of box dimensions
 - One, more units
 - Static
- Integrate Visionary-s (FFonseca)



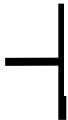
Demo



Results - One Box

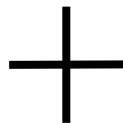


```
Time to detect all planes: 0.07405424118041992  
  
Plane equation: 0.01x + -0.03y + 1.00z + -82.68 = 0  
Plane equation: -0.03x + 0.98y + -0.18z + -295.13 = 0  
  
Plane 0 dims:  
[352.02319725 191.60946273 15.77075791]  
  
Plane 1 dims:  
[349.18152414 98.44491244 17.01451787]  
  
The box is orientated Horizontally.  
Its dimensions (LxWxH) are:  
[351, 192, 98]  
The percentage of erro in volume is: -0.18568660727910857 %.  
Real values CaixaBranca(LxWxH):  
[340, 193, 85]
```

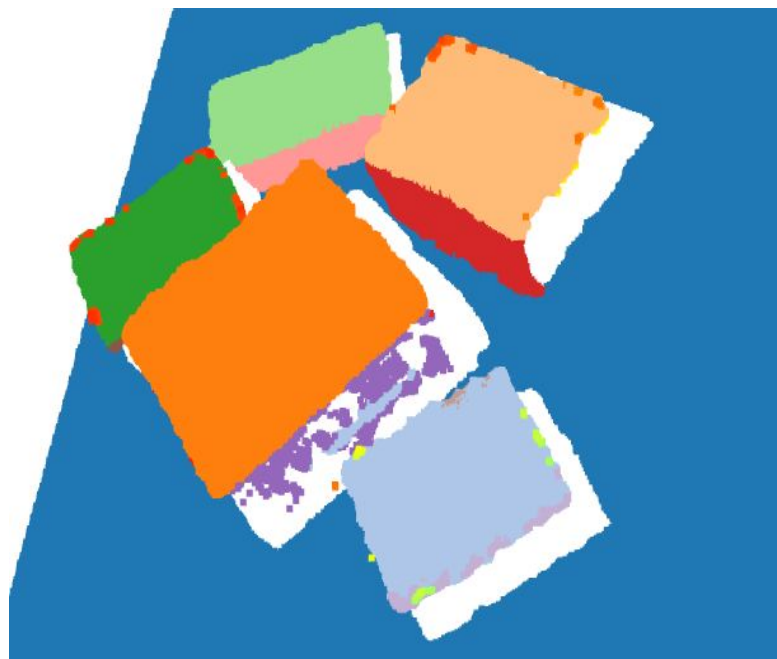
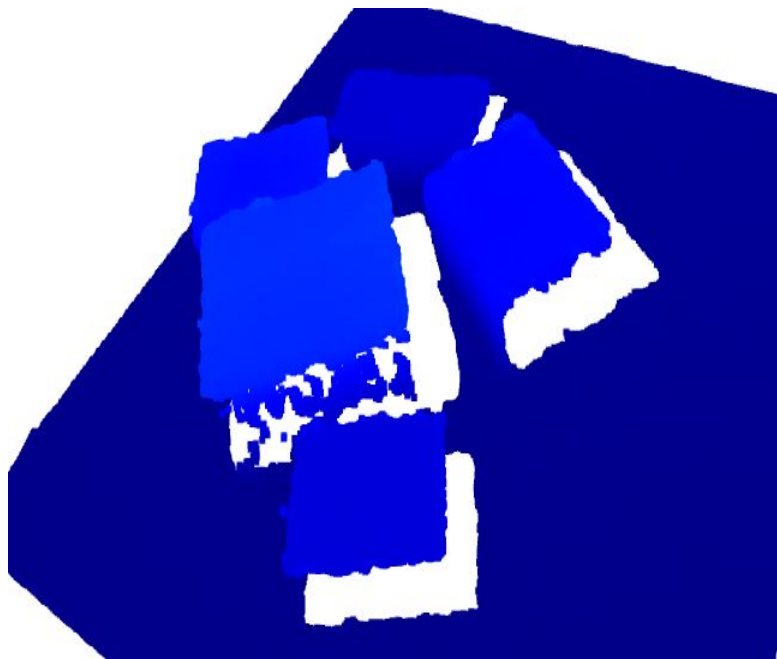


Difficulties - One Box

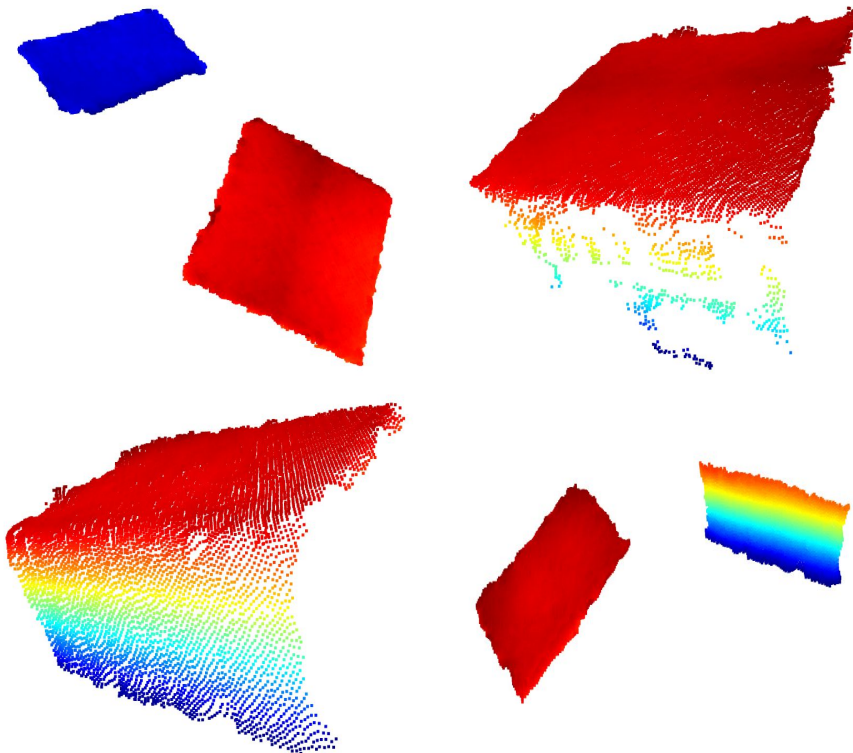
- I have two plans detected, how do I join them to get a box?
- Is our algorithm cohesive enough to be applied to any case and obtain optimal results?
 - Plan Detections
 - Dimensions
 - Orientation



Results - Multiple Boxes



Results - Multiple Boxes



```
pass 2 / 16 done.
pass 3 / 16 done.
pass 4 / 16 done.
pass 5 / 16 done.
pass 6 / 16 done.
pass 7 / 16 done.
pass 8 / 16 done.
pass 9 / 16 done.
pass 10 / 16 done.
pass 11 / 16 done.
pass 12 / 16 done.
```

```
Plane 0 dms:
[276.77698795 297.7543547
```

```
Plane 1 dms:
[348.04555572 379.85876786
```

```
Plane 2 dms:
[330.56048734 251.26168817
```

```
Plane 3 dms:
[220.07909012 289.31702816
```

```
Plane 4 dms:
[347.84648208 202.19702482
```

```
Plane 5 dms:
[324.4873282 138.7590044
```

```
Plane 6 dms:
[295.12924529 69.14380013
```

```
Plane 7 dms:
[346.39913648 204.63561785
```

```
Plane 8 dms:
[ 40.02960837 261.02860265
```

```
Plane 9 dms:
[ 16.92890365 146.52061966
```

```
Plane 10 dms:
[27.32558146 82.58864803
```

```
Plane 11 dms:
[682.82310388 741.1250761
```

```
Plane 12 dms:
[534.65590982 834.25311638
```

```
Plane 13 dms:
[527.5181747 844.65513439
```

```
Plane 14 dms:
[686.80537597 891.91622063
```

Reference boxes dimtions:

Reference box number 0 - [375, 340, 220, 0, 28050000]

Reference box number 1 - [320, 235, 155, 1, 11656000]

Reference box number 2 - [260, 215, 105, 2, 5869500]

Reference box number 3 - [280, 200, 170, 3, 9520000]

Reference box number 4 - [345, 190, 85, 4, 5571750]

The box is orientated Horizontally.

Its dimensions (LxWxH) are:

[364, 348, 202]

Represents box with Reference sizes: 0

The percentage of erro in volume is: 0.08714141930174146 %.

The plane used are: 1 and 4

The box is orientated Horizontally.

Its dimensions (LxWxH) are:

[363, 348, 205]

Represents box with Reference sizes: 0

The percentage of erro in volume is: 0.07796940461053037 %.

The plane used are: 1 and 7

The box is orientated Horizontally.

Its dimensions (LxWxH) are:

[328, 251, 139]

Represents box with Reference sizes: 1

The percentage of erro in volume is: 0.020327501341001475 %.

The plane used are: 2 and 5

The box is orientated Horizontally.

Its dimensions (LxWxH) are:

[307, 220, 139]

Represents box with Reference sizes: 1

The percentage of erro in volume is: 0.19593642418462576 %.

The plane used are: 3 and 5

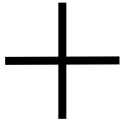
Difficulties - Multiple Boxes

- How to join the two planes correctly?
 - Boxes that have very similar sides
- What about dimensions and orientation?
- Is noise an issue?



Difficulties

- Calibration
- Point Cloud noise and angle of acquisition
- Plane detection algorithm
 - Only analyses the geometry - Ransac, DBSCAN (Open3D)
 - Better choices, DBSCAN, OPTICS, KMeans (SKLearn), HDSCAN, IA



Future Work

- Better plane detection algorithm
- Better Visualization (output data)
- Faster processing for motion analysis
- Integrate Xbox Kinect (better 2 units to easier plane processing)

