

Dynamic fusion

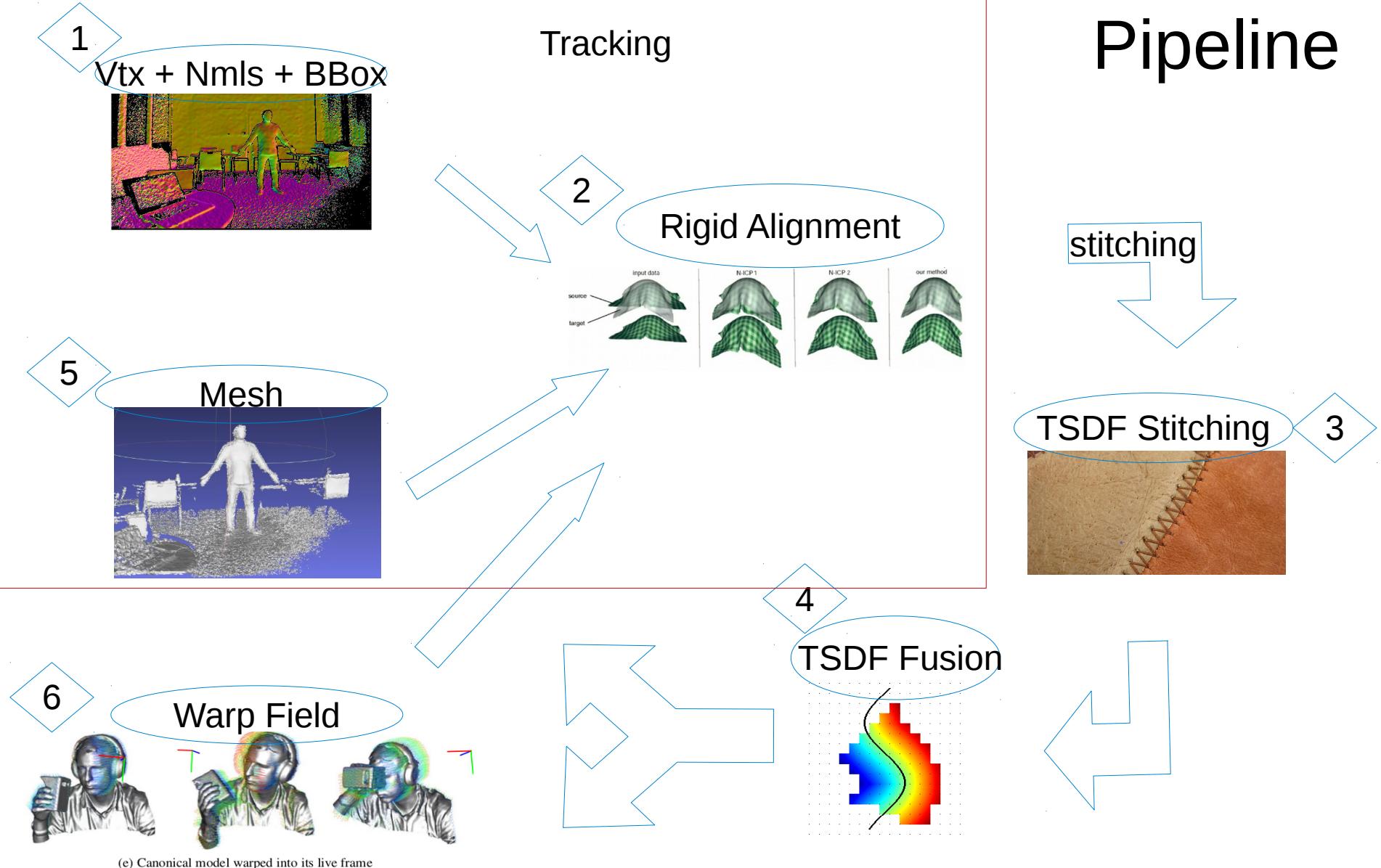


Internship Week 16
Tracking Mesh and Fusion (IV)
7th June 2017

Last meeting

- Previously
 - Identify source in tracking with Mesh
 - Mesh tracking
 - Normals correspondence
 - Change the update in mesh tracking
- Plan for today's meeting:
 - Mesh Tracking
 - Fusion

Pipeline



Progress

- Tracking with the Mesh
 - 1) Transform current image with inverse current Pose
 - 2) Projection Vtx of Mesh in current depth frame
 - 3) Compare Vtx
 - 4) Compare Nmls
 - 5) Add correspondence to matrix
 - 6) ICP

Progress

- Value algo of frame to frame tracking adapt like meshtracking

Input : one image of the String4b dataset

Input2 : same image but transform by a handmade matrix.

self.Pose: Mesh tracking

```
[ 0.99935007  0.03009299 -0.01984535 -0.01010001]  
[-0.02989301  0.99950004  0.01029763 -0.01994994]  
[ 0.02014532 -0.0096977  0.99975002 -0.02000003]  
[ 0.          0.          0.          1.          ]]
```

T_Pose2 : Frame to Frame tracking, done with the same computation of Mesh tracking

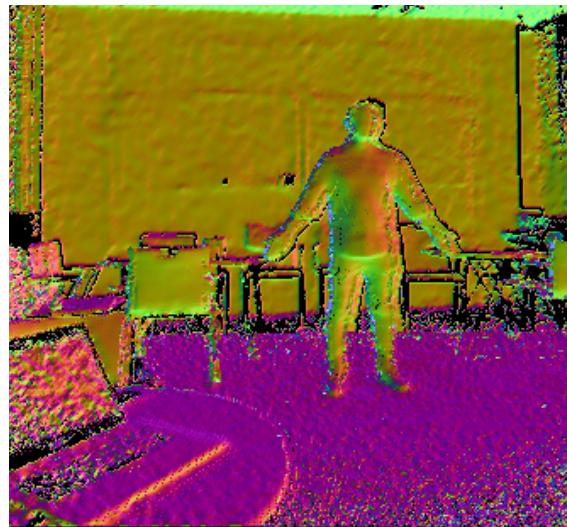
```
[ 0.99935008  0.03009299 -0.01984535 -0.01010001]  
[-0.02989301  0.99950006  0.01029763 -0.01994995]  
[ 0.02014532 -0.0096977  0.99975003 -0.02000003]  
[ 0.          0.          0.          1.          ]]
```

Very similar result => algo seems correct

Progress

- Test with different threshold for vertex
 - $0.01 \Rightarrow 0.5, 0.1$ and 0.03

Overlay with
Threshold at
0.5 instead of
0.01



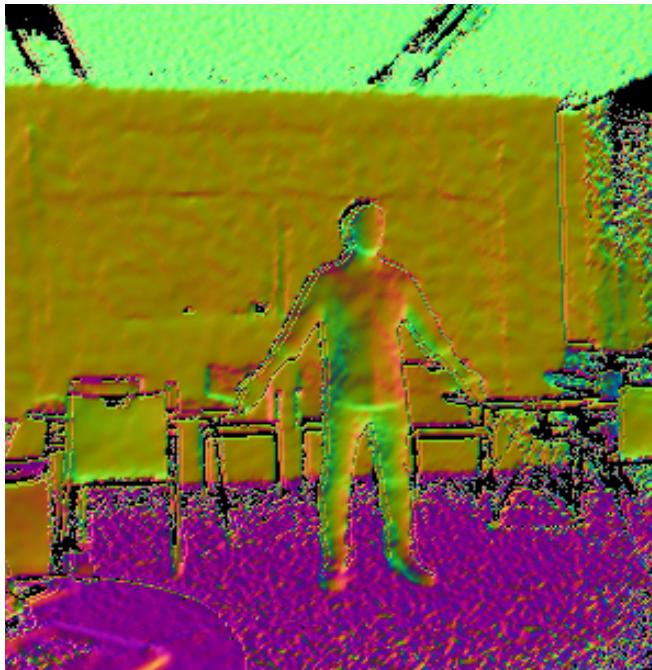
Not good but 0.5 better than others.
Change determinant threshold value with log
to get more precision

Threshold dist	Images	max	min	median	MESH
60	16	32.997	0.000099	0.005662	noisy
	17	60.3853	0.001124	0.007885	
	18	96.036	0.000022	0.010754	
	19	59.2783	0.000338	0.053353	
0.01	16	33.043172	0.000078	0.00553	noisy
	17	66.243396	0.000112	0.005796	
	18	97.114218	0	0.001639	
	19	33.278463	0	0.006003	
0.01	14	34.08955	0.000385	0.013533	good
	15	53.76247	0	0.002102	
	16	5.807737	0.000035	0.008953	
	17	55.68155	0.00016	0.009121	

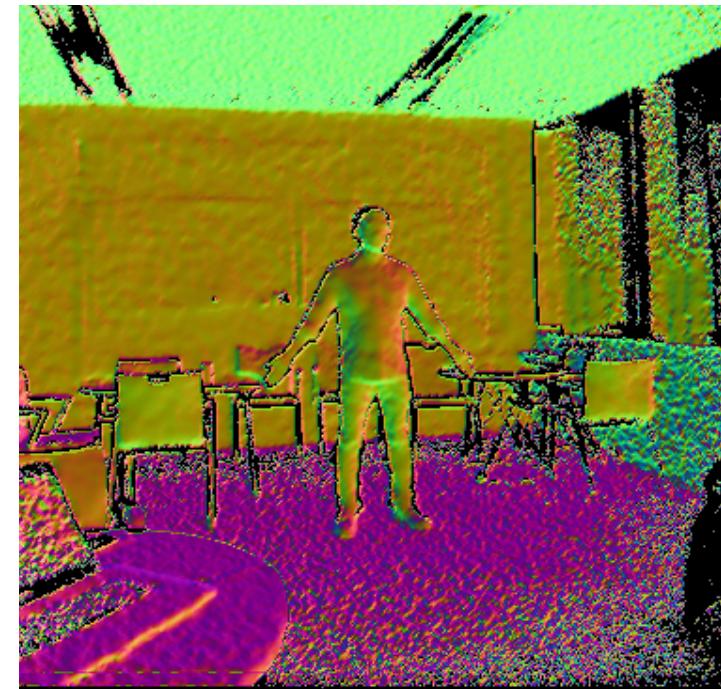
0.01 looks good

Progress

- TEST: align two successive images (comparing two methods no mesh)
 - Pose and overlay result for both method.
 - Result: Same Pose but overlay depends on how big is the transform matrix.



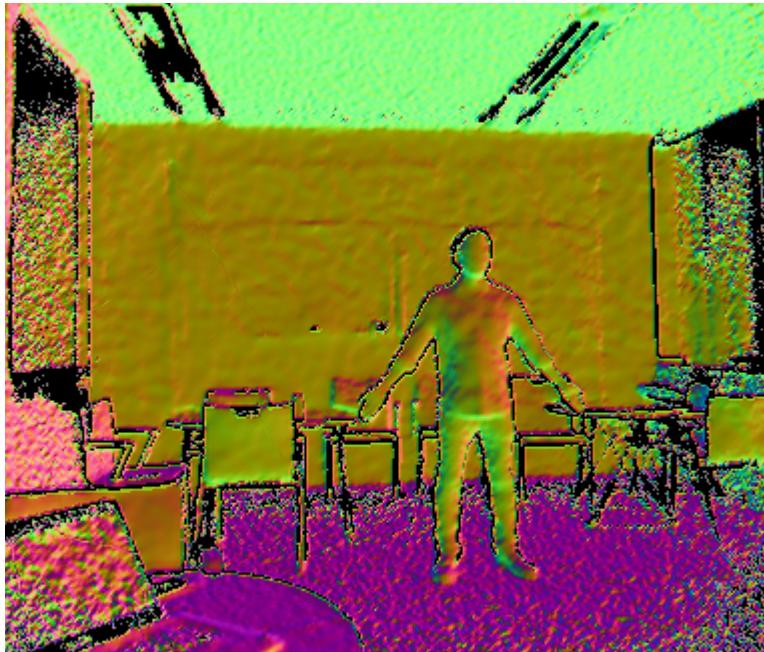
TESTRegister between image 10-11
Too big difference



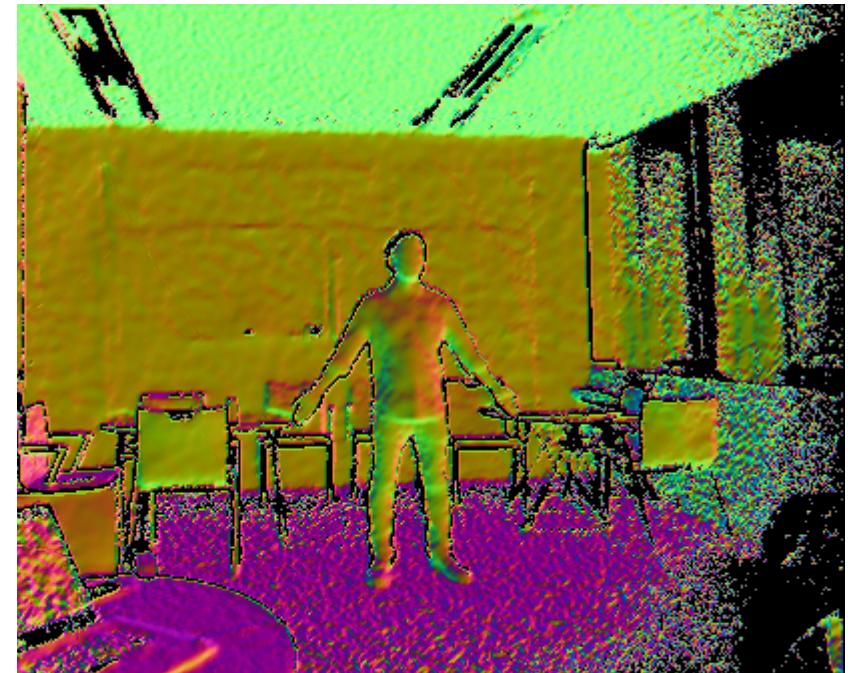
TESTRegister between image 13-14
Small difference

Progress

- TEST: same test but with former method
 - Always similar Pose different
 - However overlay ok



TESTRegister F2F Image 10-11

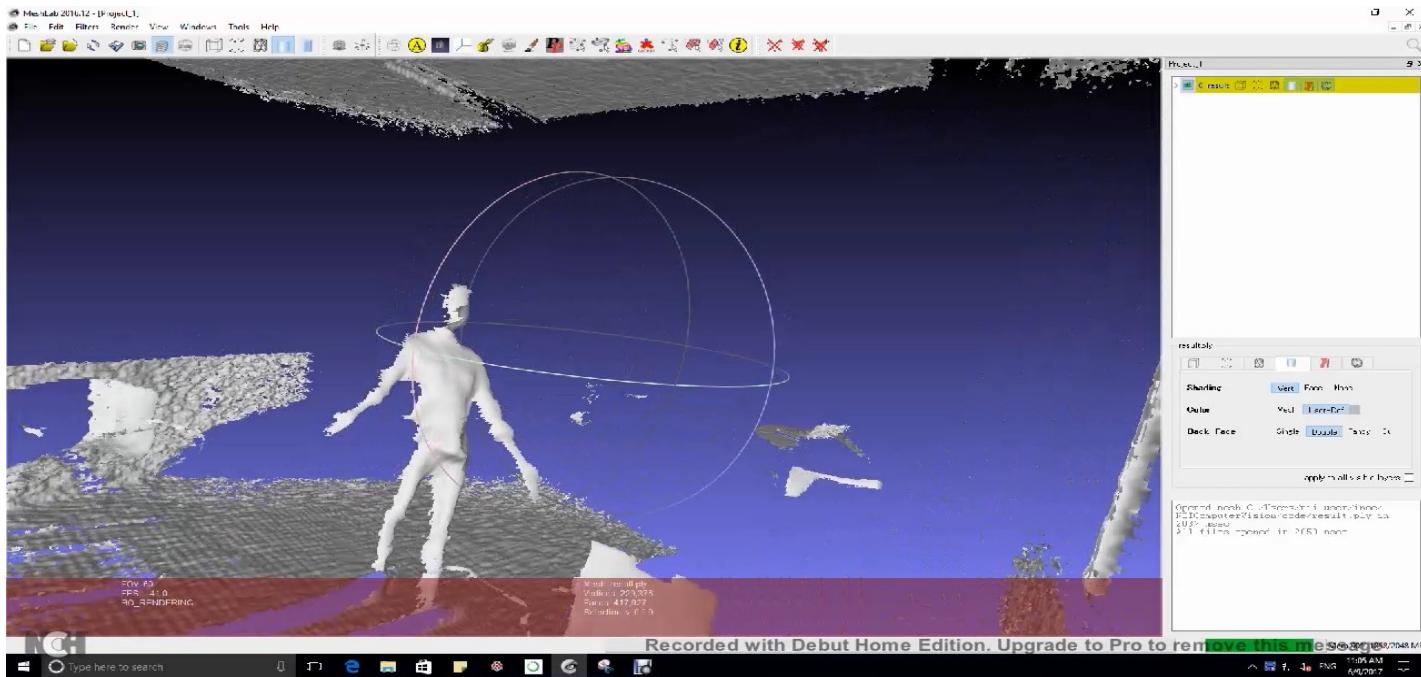


TEST Register MT Images 10-11

Conclusion : Former method more robust but not adapted to the situation

Progress

- Fusion with MT 13-17



Working.
First mesh tracking
Works only for small
change between
images

Mesh Tracking and Fusion for Image 13-17

Progress

- Change of dataset
 - <http://vision.in.tum.de/data/datasets/rgbd-dataset>



Former Dataset sequence
Big leap => see other dataset?



New dataset

Progress

- Notations:
- Mesh tracking :
 - 1) MT1 : First made algo. Transform list of Mesh and project it in the current frame
 - 2) MT2 :Transform current image and project the mesh in the current image
- Frame to frame tracking :
 - 1) F2F_1 : working method. Transform current image and project it in the second image.
 - 2) F2F_2 : same as MT2 but have a matrix instead of lists for the former image.

Progress

- Testing with new dataset
 - TEST1 : input = two first following images. First image = former image and second = current image
 - No fusion

self.Pose: MT2

```
[[ 9.99979913e-01  6.29309891e-03  7.25234044e-04 -1.46260363e-05]
 [ -6.29382674e-03  9.99979675e-01  1.00529974e-03 -8.99613860e-06]
 [ -7.18892843e-04 -1.00984413e-03  9.99999225e-01  1.03423812e-08]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  1.00000000e+00]]
```

T_Pose2: F2F_2

```
[[ 9.99979935e-01  6.29310008e-03  7.25233715e-04 -1.46260340e-05]
 [ -6.29382762e-03  9.99979688e-01  1.00529970e-03 -8.99613957e-06]
 [ -7.18892533e-04 -1.00984403e-03  9.99999232e-01  1.03419199e-08]
 [ 0.00000000e+00  0.00000000e+00  0.00000000e+00  1.00000000e+00]]
```

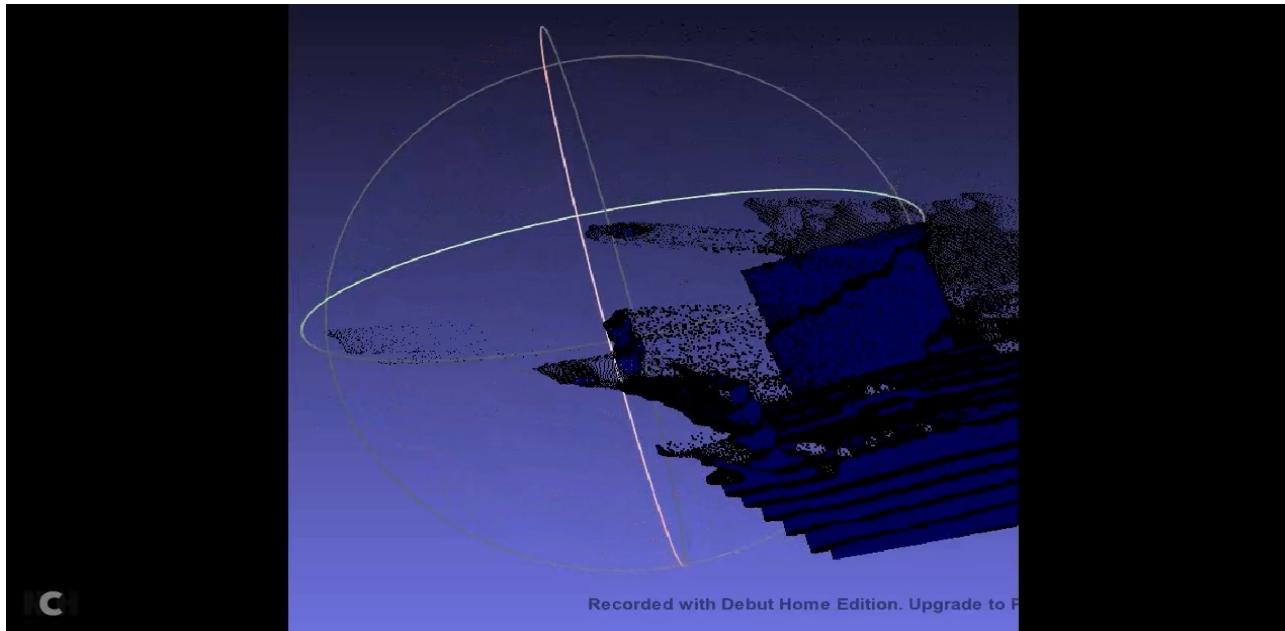
Progress

- New DataSet
 - With same input result Pose between MT2 and F2F_2 are similar. Little in the last non significant numbers
 - Dimension different [480,640] → crop after depth conversion
 - Vtx Values very differents → no faces, no correspondence → TSDF only one value → no fusion

Progress

- Testing with new dataset

- TEST3 : input = two first following images. First image = former image and second = current image
- No mesh
- Output : point of cloud

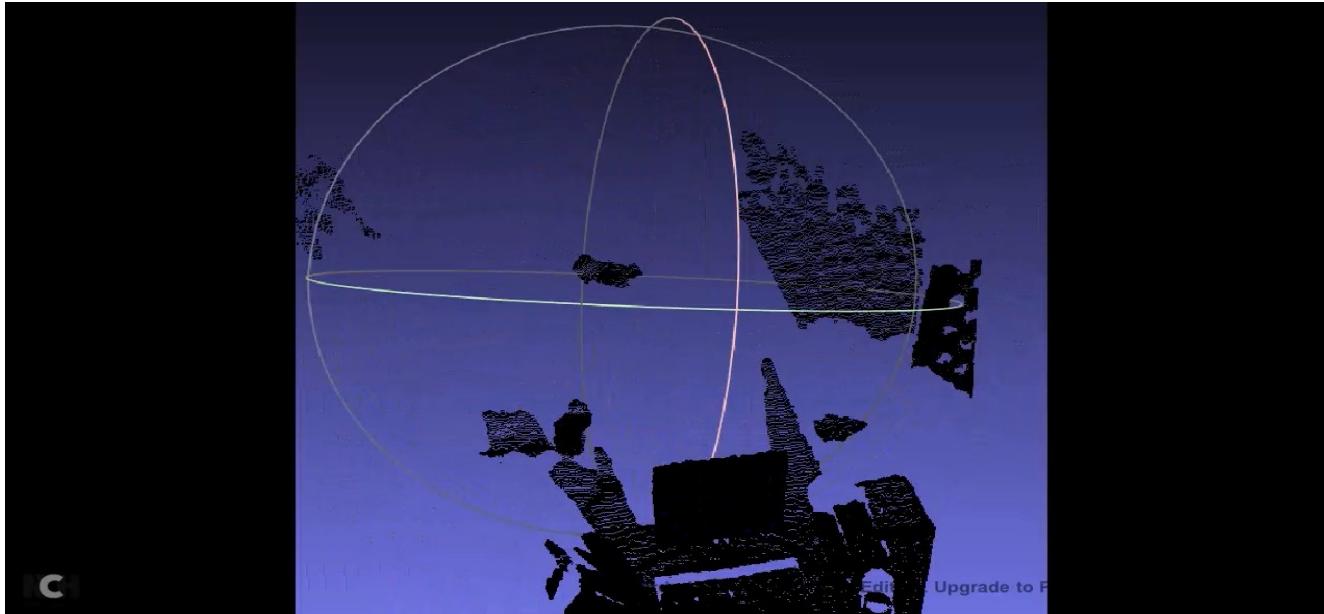


Same result without crop

Point of cloud MT2 Images 3-4

Progress

- Stairs
 - imread => Convert into int8.

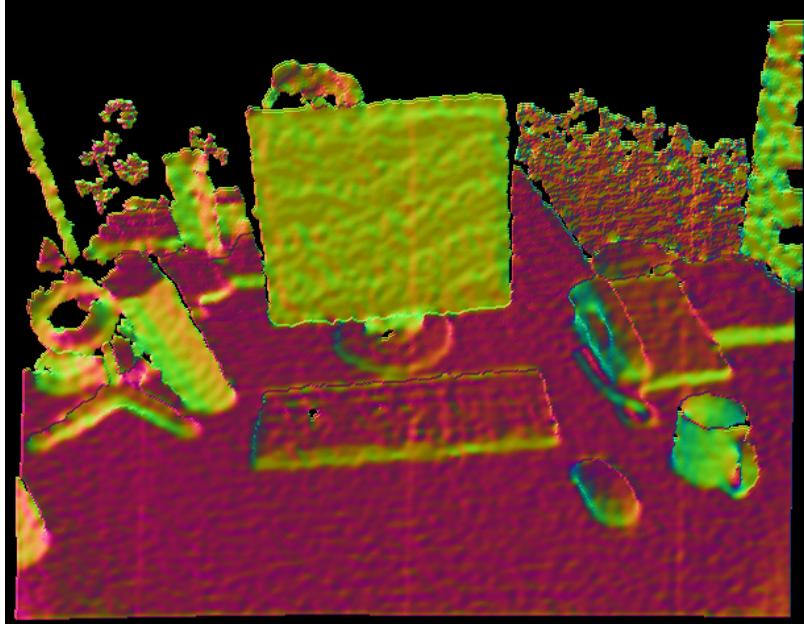


Progress

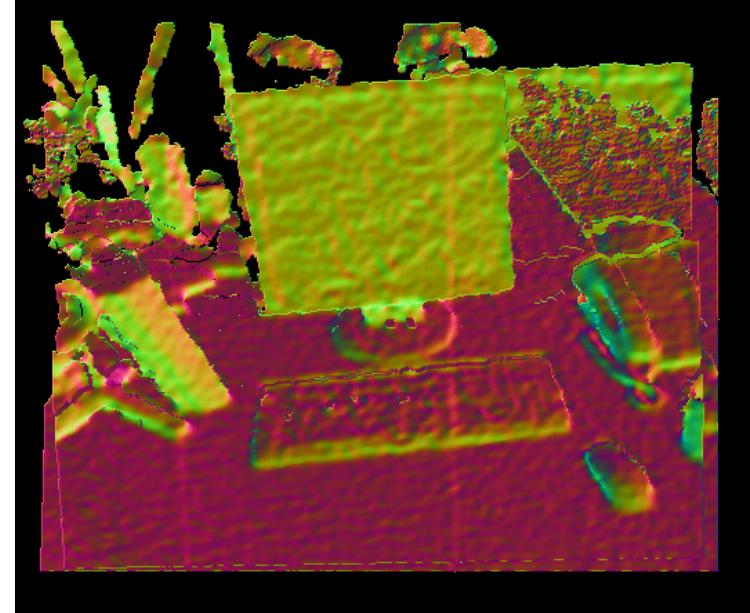
- Finding correspondences:
 - Scale the depth image to have value between 0.0 and 3.5
 - Input two following image of new dataset
 - From 0 to 148231 of correspondence by having scale

Progress

- Alignment not correct because of:
 - Scale the depth image to have value between 0.0 and 3.5
- Just divided by scale factor (=5000) given by website.



Show overlay of image 3 and 20

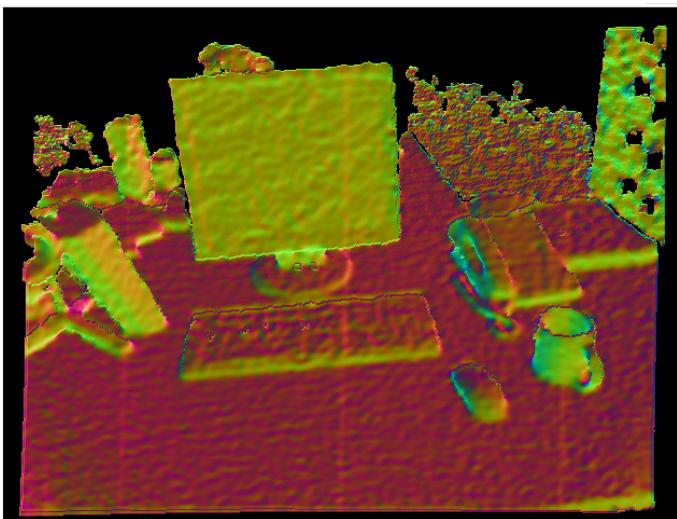


Show overlay of image 3 and 99

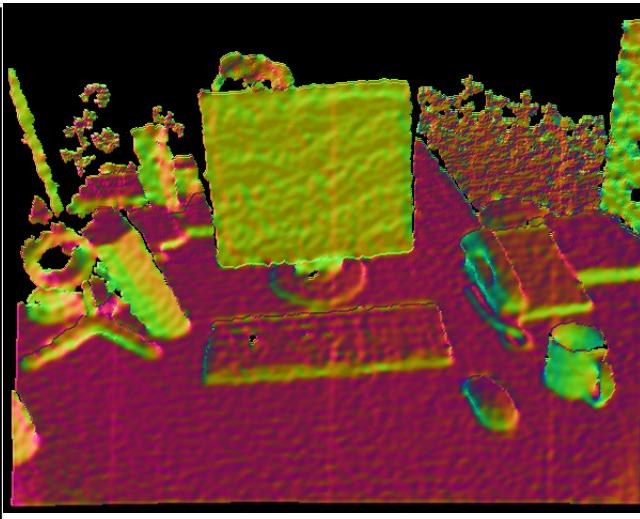
Some Error
somewhere
search first
Check former
tracking

Progress

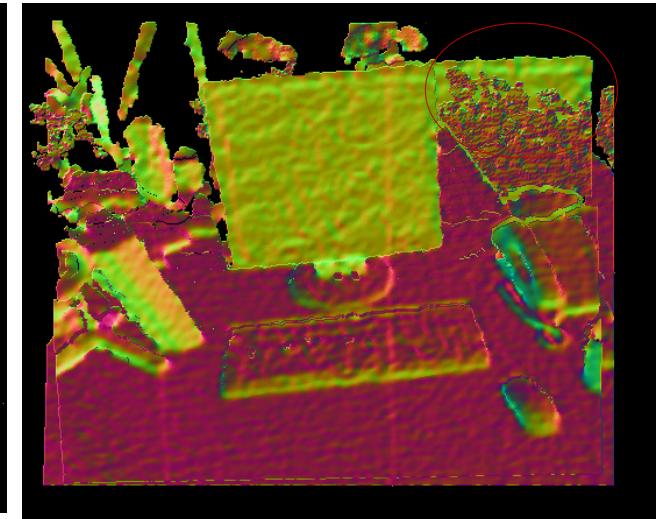
- Tracking debug:
 - Both MT2 and F2F_2 trackings similar until 20 img



NDMT2_Img3-4



NDMT2_Img3-20

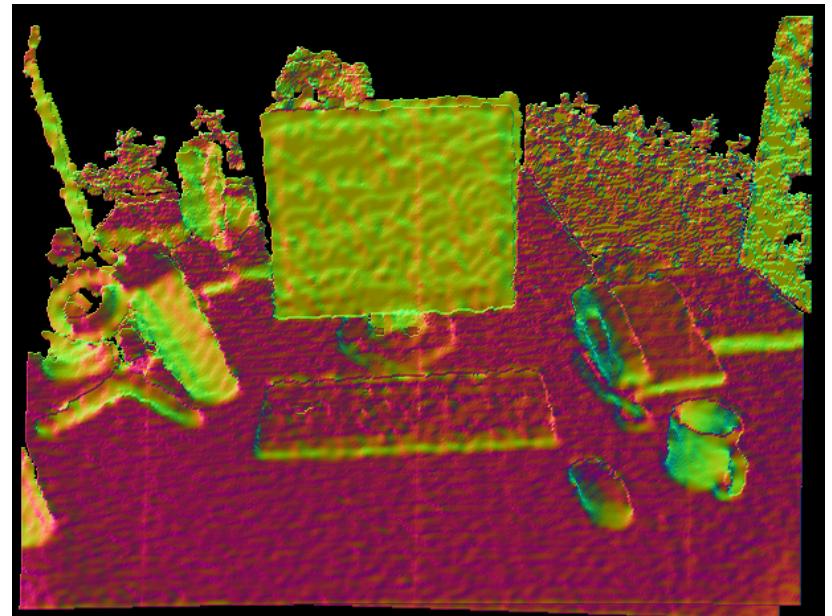
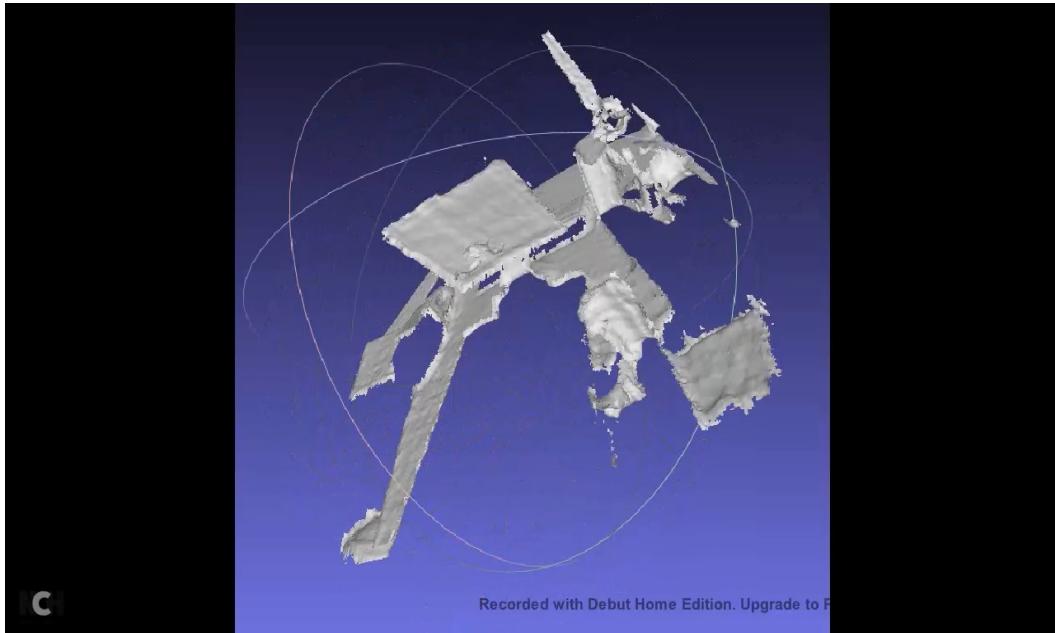


NDMT2_Img3-100

Still some problem in the initialization?

Progress

- Changing scaling factor: 2000 instead of 5000 (therefore thresholds *2.5)

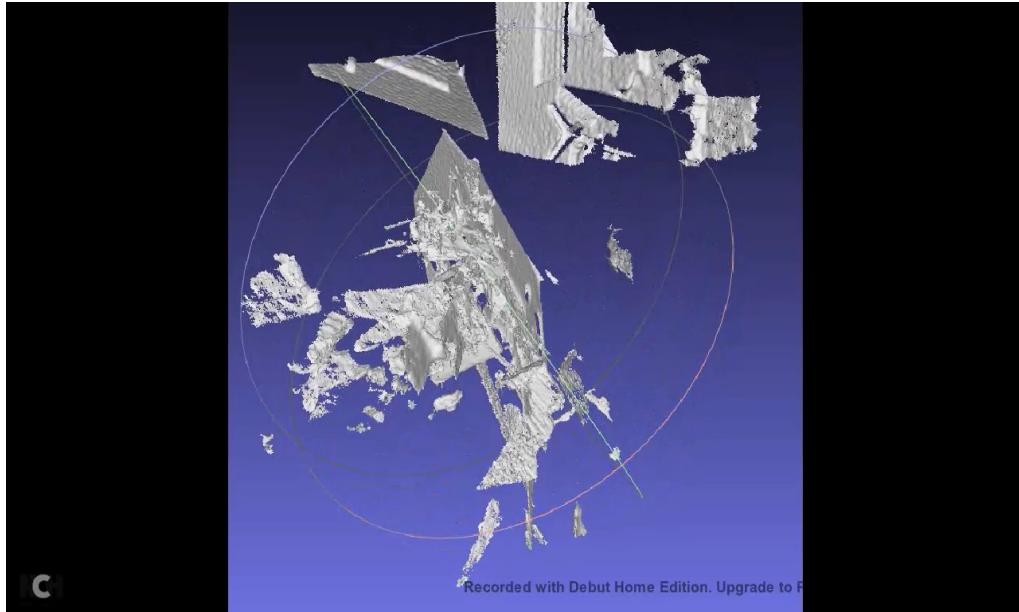


NDMT2-Img18-45Fact2000

NDMT2-Img18-45Fact2000

Progress

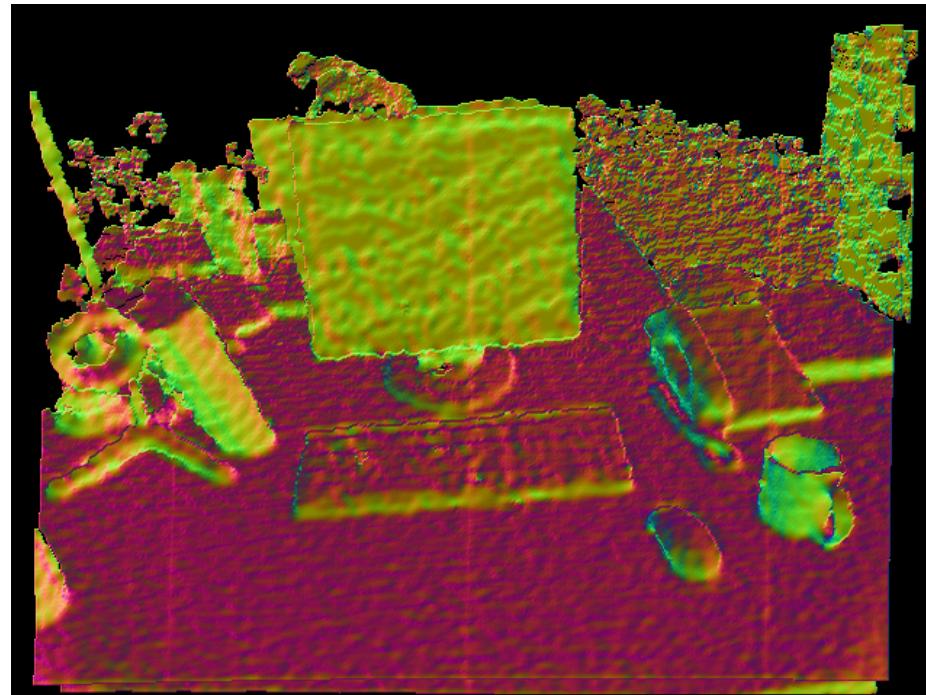
- Changing scaling factor: 2000 instead of 5000



NDMT2-Img3-40Fact2000

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Advisors : Prof. A.Sugimoto
Dr. D.Thomas

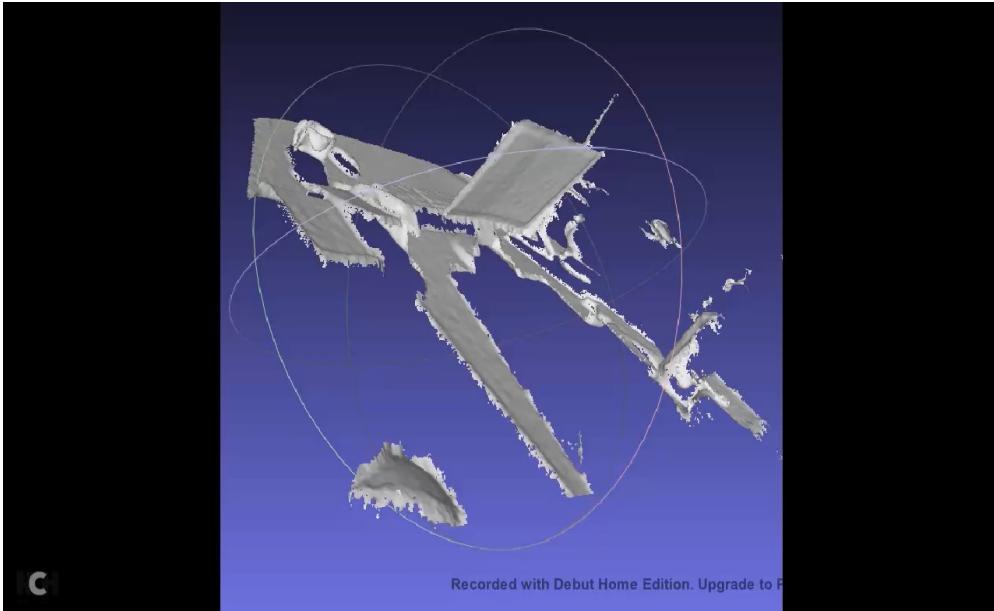


NDMT2-Img3-40Fact2000

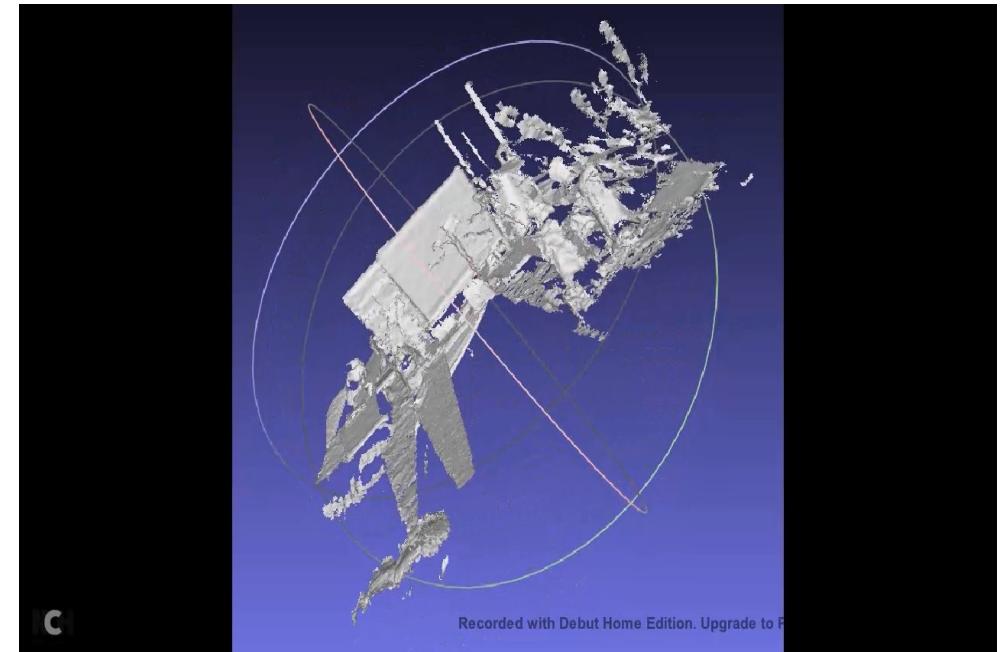
MT2 → wrong

Progress

- Using MT1 instead of MT2



NDMT-Img3-40Fus

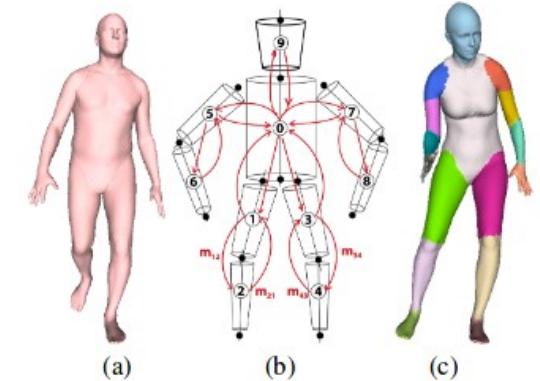


NDMT-Img3-60Fus

Problem in translation?

Progress

- Research papers:
 - S. Zuffi and M. J. Black. The stitched puppet: A graphical model of 3D human shape and pose. In Proc. CVPR, 2015.
 - Combining realistic model and part-base model
 - M. Slavcheva, M. Baust, D. Cremers, S. Ilic KillingFusion: Non-rigid 3D Reconstruction without Correspondences. IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Honolulu, USA, July 2017



Action plan

- Mesh tracking
- Read papers : conceive algo
- Fusion for each segmented body part separately:
 - Coordinates change one by one
 - Fuse one by one

Q&A

- Segmented fusion : very small but new volume? Or included in the big volume?
- Which data for segmented fusion?