

Dynamic fusion

Internship Week 7 Bounding Boxes 31 March 2017

Last meeting

- Previously
 - Presentation of 1st part dynamic fusion.
 - Segmentation of hand and feet (think in time)
 - No result for bounding boxes
- Plan for the week:
 - Bounding Boxes (output = Transform and size)
 - Visualization
 - Second presentation of dynamic fusion
 - OpenCL

Dynamic Fusion

- From rigid body to motion

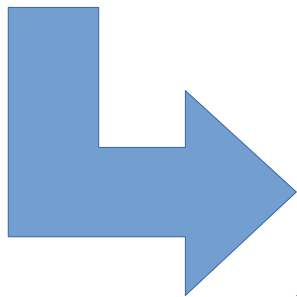


(a) Initial Frame at $t = 0s$

Kinect Fusion



(d) Canonical Model



Dynamic
Fusion

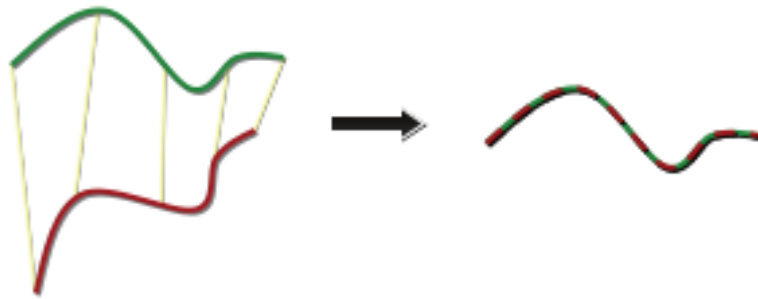


(e) Canonical model warped into its live frame

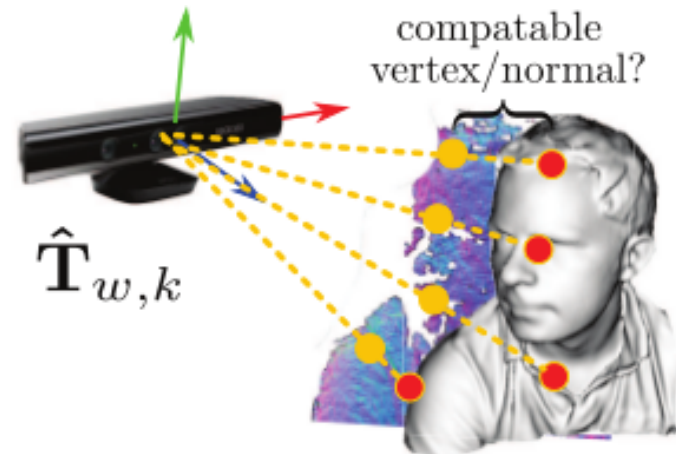
Dynamic Fusion

- Estimating the surface

Find correspondence
=
Data association



Point to metric correspondence
=
Minimize point to plan distance



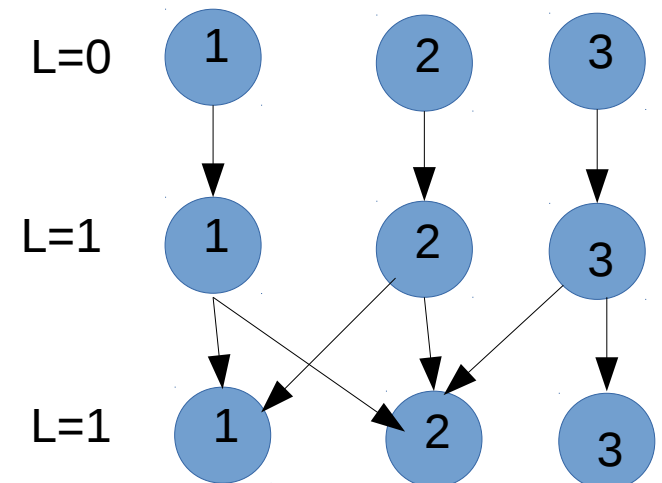
Dynamic Fusion

- Regularization:
 - Estimate whole space for new views

$$\text{Reg}(\mathcal{W}, \mathcal{E}) \equiv \sum_{i=0}^n \sum_{j \in \mathcal{E}(i)} \alpha_{ij} \underbrace{\psi_{\text{reg}}}_{\text{Rigidity}} \left(\underbrace{\mathbf{T}_{ic} \mathbf{d}\mathbf{g}_v^j - \mathbf{T}_{jc} \mathbf{d}\mathbf{g}_v^j}_{\text{Edge}} \right), \quad (8)$$

→ Edge
→ Preserving discontinuity

- Hierarchical Deformation Tree
 - Smoothness
 - Computational



Dynamic Fusion

- Optimization:
 - Gauss-Newton approximation of Hessian

$$E(\mathcal{W}_t, \mathcal{V}, D_t, \mathcal{E}) = \mathbf{Data}(\mathcal{W}_t, \mathcal{V}, D_t) + \lambda \mathbf{Reg}(\mathcal{W}_t, \mathcal{E})$$

Reformulation

$$\mathbf{J}^\top \mathbf{J} = \mathbf{J}_d^\top \mathbf{J}_d + \lambda \mathbf{J}_r^\top \mathbf{J}_r$$

- Simplifications:

$$A = \begin{bmatrix} * & * & * & * & * \\ * & * & 0 & 0 & 0 \\ * & 0 & * & 0 & 0 \\ * & 0 & 0 & * & 0 \\ * & 0 & 0 & 0 & * \end{bmatrix}$$

$$\mathbf{T}_{lw} \leftarrow \tilde{\mathbf{T}} \mathbf{T}_{lw}$$

Arrow-head

Dynamic Fusion

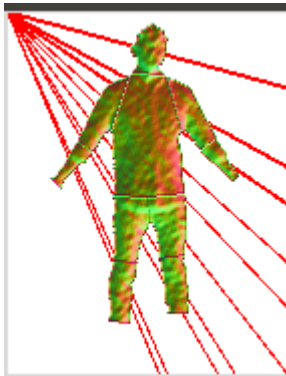
- Limitations:
 - Opening topology
 - Large inter-frame motion
 - Highly dynamic scene
 - Memory
 - Growing warp field

Progress

– Bounding Boxes

- Code done but still debugging

No coordinates system in the visualization for now



Center computation on cropped image

```
[[ -0.49329093 -0.31858228  0.80942535  32.54576857]
 [  0.62955706 -0.77287877  0.07947528  32.54576857]
 [  0.60026825  0.54878388  0.5818198   1.         ]
 [  0.         0.         0.         1.         ]]
[[ -4.57086920e-01 -3.71605318e-01  8.08072420e-01  4.78708662e+01]
 [  6.16327394e-01 -7.87374969e-01 -1.34610902e-02  4.78708662e+01]
 [  6.41258209e-01  4.91884281e-01  5.88929337e-01  1.00000000e+00]
 [  0.00000000e+00  0.00000000e+00  0.00000000e+00  1.00000000e+00]]
[[ -3.50799265e-01 -3.47125093e-01  8.69737918e-01  1.05867635e+02]
 [ -6.20764887e-01 -6.09178284e-01 -4.93510661e-01  1.05867635e+02]
 [  7.01135387e-01 -7.13025938e-01 -1.78377434e-03  1.00000000e+00]
 [  0.00000000e+00  0.00000000e+00  0.00000000e+00  1.00000000e+00]]
[[ -3.73021994e-01 -3.87651810e-01  8.42959469e-01  9.17139903e+01]
 [ -5.11198330e-01 -6.72329155e-01 -5.35396838e-01  9.17139903e+01]
 [  7.74293781e-01 -6.30634269e-01  5.26266040e-02  1.00000000e+00]
 [  0.00000000e+00  0.00000000e+00  0.00000000e+00  1.00000000e+00]]
[[ -0.45139836 -0.26248359  0.85284341  61.06818504]
 [  0.82992879 -0.47460877  0.29319741  61.06818504]
 [  0.32780745  0.84014813  0.43208031  1.         ]
 [  0.         0.         0.         1.         ]]
```


Progress

- OpenCL:
 - My personal computer do not have GPU
 - Licence for windows

Action plan

- Finish Bounding Boxes
- OpenCL, Windows
- Start fusing data for segmented body

Q&A

- Internship Oral
- Windows : time
- How can I change the image that is sensible to keyboard or mouse?