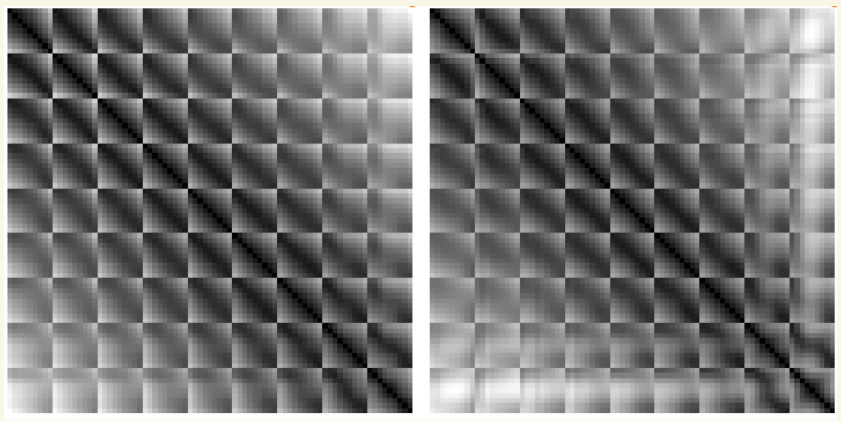
3D Reconstruction of Non-Rigid Shapes

Overview

- 3D reconstruction system based on convolutional neural networks with loss function built on top of distance matrices
- Test version of the novel synthetic dataset of cloth deformed over time

Distance matrix

- **Capturing topology** – loss function composed of distance matrices of predicted and target shape
- Such a matrix consist of *NxN* pairwise distances between each point in a processed mesh (where N is a total number of points)



Axis weighting

- **Problem:** our system is able to successfully reconstruct shapes in x and y-axes, but is almost completely insensitive on changes in the z-axis
- **Cause:** differences in z-axis were relatively insignificant in comparison with x and y
- **Proposed solution:** weighting loss function in axes by computing ratio of label and prediction variances in each of them and make learning dependent on it

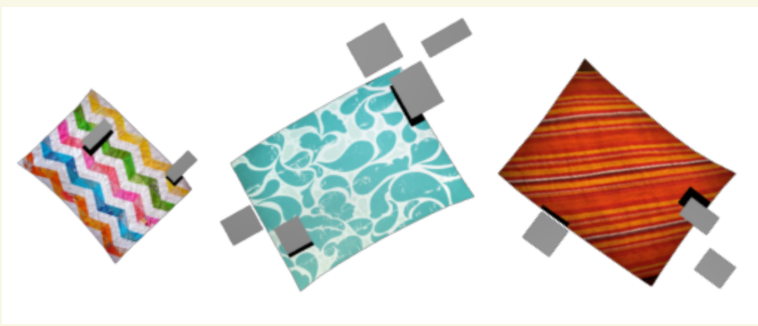
Experiments

- Comparison with the state of the art method, which loss function was based on **RMSD** measure
- First tests shows that both methods are **comparable** in the overall result

	Mean error		
Method	X	Y	Z
RMSD	0.40	0.46	0.18
Distance matrix	0.46	0.46	0.15

Dataset

- **2500 training and 260 validation** synthetic samples of deforming cloth.
- Object attached in the space and the wind is blowing on it with randomly changing strength and direction
- Changing textures, materials and sizes of generated objects.



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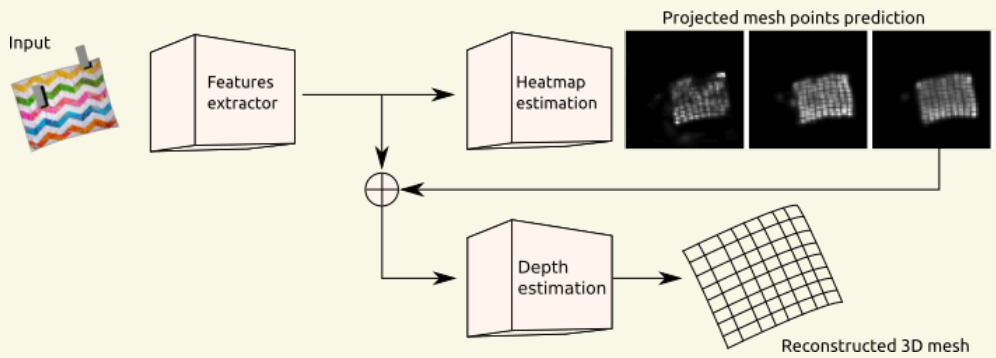
Proposed method

- **Heat-maps** of projected 3D points are estimated in iterative manner (refinement is visible from left to right)
- Maps used as an attention mechanism for the input features
- Depth estimation obtained by reprojection model



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