Mathematisch-
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Fakultät

Computergrafik

Masterarbeit

Pretty Planes and ugly toilets

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Selbstständigkeitserklärung

Hiermit versichere ich, dass ich die vorliegende Masterarbeit selbständig und nur mit den angegebenen Hilfsmitteln angefertigt habe und dass alle Stellen, die dem Wortlaut oder dem Sinne nach anderen Werken entnommen sind, durch Angaben von Quellen als Entlehnung kenntlich gemacht worden sind. Diese Masterarbeit wurde in gleicher oder ähnlicher Form in keinem anderen Studiengang als Prüfungsleistung vorgelegt.

Denis Heid (Matrikelnummer 3827662), May 14, 2019

Abstract

Template

Acknowledgments

If you have someone to Acknowledge;)

Contents

1. Introduction

1. List different representations of objects (meshes, pointcloud, voxels,structured light, kinect depth..)

What is this all about?

1.1. Problem Statement

2. Background

Often in computer graphics, it is necessary to process three-dimensional objects. There are many ways to acquire data of the surface of such geometry and more so many techniques to transform and augment that data to a distinct representation. This often non-trivial task is crucial to further process the object in question in later stages of their respective pipelines. Over the years many representations of acquisition data formats and transformation methods, as well as target data formats, have accumulated.
In this chapter, various of these techniques and data formats are examined, of which some of them are used in this work as a vehicle for a novel data transformation routine.
Initially, classical approaches are examined in section 2.1 which do not rely on artificial intelligence or machine learning methods. With the recent advances in deep learning, many new approaches have been developed and thus considered in this work. Hence, the general concept of deep learning and neural networks are then reviewed in section 2.2. Subsequently, these more specific machine learning based methods are reassessed in section 2.3 which rely on distinctive statistical features in their initial data format or the dataset itself, thus allowing for the transformation.

2.1. Classical approaches

1. non trivial task (etwas mathematischer, genauer werden)
2. have to define your input and output model mathematically nicely

Papers to cite here

1. Marching cubes
2. Fabians [GRL17]
3. instant field aligned meshes
4. Dennis paper[BL18]

2.2. Machine Learning review

2.3. Machine Learning approaches

1. machine learning good way for inference, probably neural network too, given huge amount of data and finding similarities in data
2. many approaches for surface reconstruction in classic ml
3. used for self driving cars. Fast solutions
4. NN recently started to get nice results
5. many try to transform given input data to voxel based representation
6. not many directly from point cloud to meshes
7. range scanner to meshes
8. end result not meshes?

Papers to cite:

1. Convolutional neural network
2. Semi-Supervised Classification with Graph Convolutional networks
3. dense 3d object reconstruction from single depth view
4. PointNet++
5. deep marching cubes
6. pixel2mesh
7. learning a hierarchical latent-variable model of 3d shapes
8. FlexConv
9. unsupervised learning of 3d structure
10. image2 mesh
11. Surface reconstruction from unorganized Points

TODO: Find non NN ML papers, from the other prof of ML lecture? TODO: Saliency for feature detection

3. Material

3.1. Data

Explain and show

4. Methods

5. Results

6. Discussion

Test 123

7. Outlook

A. Blub

Bibliography

[BL18] Dennis R. Bukenberger and Hendrik P. A. Lensch. Hierarchical Quad Meshing of 3D Scanned Surfaces. *Computer Graphics Forum*, 37(5):131–141, 2018. https://diglib.eg.org/bitstream/handle/10.1111/cgf13497/v37i5pp131-141.pdf.

[GRL17] Fabian Groh, Benjamin Resch, and Hendrik P. A. Lensch. *Multi-view Continuous Structured Light Scanning*, pages 377–388. Springer International Publishing, Cham, 2017.