Dipl-Diss Seminar
SS 2021

PRIP

April 20th, 2021 at 13:00 s.t.
via Zoom

Programme

Pattern Recognition: Applications and New Concepts

Object Recognition for 2D Baggage Screening

Anna Sebernegg, e1526184@student.tuwien.ac.at
(BSc candidate)

X-ray screening that generates either 2D or 3D images significantly impacts security applications such as baggage handling. These systems help detect objects, especially threat items such as explosives or weapons, within closed luggage otherwise not visible to the naked eye. Still, objects are challenging to recognize within baggage, especially for the human eye. The used X-ray images are quite complex due to the weak visual signals in high background noise levels and the compact assembly of rotated and overlying objects in bags. Despite much research and recent developments regarding X-ray technologies, automated object detection is not precise enough to rely on it entirely. Consequently, baggage screening still depends on human operators. Nevertheless, object recognition algorithms support these experts with data analysis by detecting conspicuous objects and materials. Automated object detection could be further adapted in a way that helps focus the viewer's attention on critical content that requires further investigation. This could be achieved by not only automatically detecting and highlighting prohibited items but everyday objects that can be reliably recognized - allowing, for instance, filtering out unnecessary information.

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Water's Gateway: Segmentation based on U-Net architecture

Rachel Grexová, e1605767@student.tuwien.ac.at
(BSc candidate)

Watergate project is dealing with microCT volumes of a leaf recorded at five different times. They were scanned to be detect changes of cellular geometry during the opening and closing of stomata. A stack of 2D microCT images were taken along the 3 orthogonal axes and were sparsely manually segmented. The aim of my bachelor thesis is to get a fully segmented volume of the leaf on cellular level.

The segmentation is done by convolutional neural network based on U-Net architecture (Ronneberger, Fischer and Brox, 2015). The contraction in U-Net consists of convolution, ReLU activation and pooling followed by doubling of the number of feature channels. The expansion consists of the up-convolution halving the number of feature channels and concatenation with the corresponding contracting path. At this point the segmentation is done at 2D level along the 3 orthogonal axes. The class weighting was used to reduce the effects of class imbalance and data augmentation was used to increase the amount of segmented data used for training.

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Towards Real-Time Video Inpainting

Aron Ingruber, e1634059@student.tuwien.ac.at
(MSc candidate)

Video inpainting refers to the task of recovering missing data in a video. The goal is to fill in the missing data in such a way that it is impossible to tell if the video has been manipulated or not.

In recent years there have been significant advancements in the field of video inpainting by making use of deep neural networks. Most research focuses on offline video inpainting, i.e. the proposed methods make the assumption that the whole video is available before the start of the video inpainting process. This assumption is reasonable for a wide variety of applications, such as video editing or film restoration. However, some areas of applications cannot rely on this assumption but instead need to process the video as it is recorded in real-time, e.g. live television broadcasting.

This works examines a recently proposed offline video inpainting methods and adapts it to support real-time video inpainting. Furthermore, the effects of these modifications are evaluated qualitatively and quantitatively with regard to their processing speed and their visual quality.

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Generalized conics with the sharp corners

Aysylu Gabdulkhakova, aysylu@prip.tuwien.ac.at
(PhD candidate)

In this talk I would like to present the results from the last paper of the same name. The paper analyses the properties of generalized conics which are generated from N focal points with various weights. The weighting enables to obtain up to N corners associated with the focal points. The corresponding level sets capture the convexities and concavities of the shape. From shape analysis perspective, the generalized conics enrich the variety of shapes that can be described or represented.

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Graphs, Combinatorial Maps, and Pyramids

3D Feature Recognition of Design Features via a Hybrid Graph Learning System

Christian Brändle, christian.braendle@gmx.at
(MSc candidate)

The main goal of this research is to recover the design intent of a CAD/CAM-constructor via detection of design features on a boundary representation model.

The detected 3D geometric features are used to conclude design features that are machined by corresponding machining features that are common in CAM production processes.

The tracked design features are combined to reverse the production process from a machined stock to a not machined bulk.

There are different levels of abstraction for features. Starting from geometric features detectable from the boundary representation model, design features can be concluded which represent the design intent of the designer in a CAD system resulting in machining features that provide the basis for a CNC machine to machine a certain machining volume with a certain strategy in a CAM system. So a geometric feature is based on bare geometry recognition, a design feature represents the logical design intention of a constructor in a CAD environment, and a machining feature can be processed by a CNC-machine.

A design feature always have central parametric elements which describe essential parts of its nature. The main goal is to recover the design intent of the model designer to enable a reparametrization of a parametric design feature to adapt or change those design intents.

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Connected Component Labeling using Irregular Graph Pyramid

Majid Banaeyan, majid@prip.tuwien.ac.at
(PhD candidate)

This presentation presents my recent research regarding Connected Component Labeling (CCL) using irregular pyramid. First, it introduces the new algorithm, namely "Pyramidal Connected Component Labeling", and then it shortly discusses the properties of the algorithm including advantages and disadvantages. In addition, the concept of "Redundant" connections in the binary pyramid is explained. Finally, it lists open problems and issues and how we would tackle them in the future work.

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Towards improving the Combinatorial image pyramid software

Darshan Batavia, darshan@prip.tuwien.ac.at
(PhD candidate)

Combinatorial maps are used as an efficient data structure for representing the planar region adjacency graph of an image. The topology of the image is intrinsically encoded in the combinatorial maps, which serves as a major advantage as compared other graph representations like an adjacency matrix or an adjacency list. For example, a pending vertex inside a self-loop will have a same adjacency matrix as that of a pending vertex outside a self-loop. Such structurally different objects are very well differentiated by the combinatorial maps. The main goal of the research was to develop a parallel algorithm using the combinatorial maps for construction of a topology preserving irregular image pyramids also referred as a combinatorial pyramid.

The research focuses on the pipeline of the algorithm for building an irregular image pyramid rather than the well developed theory of the combinatorial maps and the combinatorial pyramid. The presentation also demonstrates the results for some artificially generated binary as well as grey scale images, for which the ground-truth is known (or can be easily predicted). It also discusses the advantage, the issues and their possible solution for further improving the software.

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