Vienna University of Technology,
Faculty of Informatics,
Institute of Computer Graphics and Algorithms,
Pattern Recognition and Image Processing Group

DiplDiss Seminar
Winter Term 2015
November, 18th 2015

Program:

13:00 – 13:05 Opening (Walter Kropatsch, Aysylu Gabdulkhakova)

13:05 – 13:15 Development of a pose-independent representation of 2D horse shapes (Julian Pegoraro)

13:15 – 13:25 Face recognition in unconstrained video streams (Philipp Omenitsch)

13:25 – 13:35 Markerless Tracking of Facial Features for Facial Palsy Analysis (Barbara Koneczny)

13:35 – 13:45 Multi-camera visual saliency (Majid Banaeyan)

13:45 – 13:55 Smart Camera Image Stitching (Hanna Huber)

13:55 – 14:05 Shape representation and classification using topology and local features (Ines Janusch)

14:05 – 14:15 Ellipse-based elongated shape representation (Aysylu Gabdulkhakova)

14:15 – 14:25 Worm spawning behavior tracking (Daniel Pucher)

14:25 – 14:35 Automatic segmentation of knee cartilage in MRI using particle filters (Patrick Valdellon)

14:35 – 14:45 Localization and Tracking of Trains in Optical Time Domain Reflectometry (OTDR) Signals (Adam Papp)

14:45 – 14:55 Background modeling of a video sequence (Tomas Musil)

14:55 – 15:05 Segmentation of Human Teeth Contours in Dental Radiographs Using Active Shape Models and Monogenic Features (Michael Sprinzl)

15:05 – 15:10 Closing (Walter Kropatsch, Aysylu Gabdulkhakova)
Detailed Program

Development of a pose-independent representation of 2D horse shapes
(Julian Pegoraro) BSc

The aim of this work is to create a pose-independent representation of a horse. In order to enable this, we need a video file as input, which contains a sequence of poses from a single horse. The first step is to segment the horse on the image, which is obtained from the video sequence. In this step, the shape and its boundary are obtained, and a binary mask will be created.

The second step is to find the marker, which are painted on the horse. These markers can be found in the boundaries of the shape, which was created in the first step. These markers can be tracked all over the video sequence.

The third step is to determine the medial axis of the shape, which was created in the first step. On each point of the medial axis will be inserted a circle, which increases, until it touches the boundary of the horse shape.

In the last step, the markers and the medial axis are used to normalize the pose of the horse.

These steps are performed with three different poses of the horse: the standard pose, the pose after a step back, and the pose after a step forward. Such a normalized representation of the horse will allow comparing different horses and measuring between-animal variations, which are interesting and essential for breeding. The results, which are obtained, have to be evaluated.

Face recognition in unconstrained video streams
(Philipp Omenitsch) MSc

Face recognition in images and video is a longstanding goal of computer vision. Applications of this technology include face verification from static images and video analytics such as counting appearance of public figures on TV, recognizing customers in retail, law enforcement by finding criminals, etc. Face recognition, however, is a difficult problem due to subtle differences in images of different individuals and large visual variability of images of the same person due to different viewpoints, lighting, facial expressions, resolution and other factors. While face recognition from static images has matured in recent years, face recognition in video has received less attention. In addition to the challenges of face recognition in still images, where people often pose in front of a controlled camera, faces in video sequences typically
appear in less controlled conditions with large variations of quality. On the other hand, complementary information in consecutive video frames, e.g. observations of the same person from different viewpoints, can be explored to improve recognition performance. The goal of this Master thesis is to advance face recognition in unconstrained video streams.

**Markerless Tracking of Facial Features for Facial Palsy Analysis**  
*(Barbara Koneczny) MSc*

Facial nerve paralysis is a paralysis of the muscles which are innervated by the seventh cranial nerve, resulting in partial or total paralysis of the muscle tone. This causes restrictions of the neural actuation of muscles responsible for facial expressions which causes asymmetric facial movement. A way to treat facial palsy is to apply neuromuscular reconstruction methods. The evaluation of the healing process and the progress in reestablishing the muscle tone and symmetric facial movement is essential for the further treatment of the patient. The currently used system for estimating the progress after the surgery lacks in precision and time efficiency. In order to overcome those deficiencies a markerless tracking system should be introduced.

Elliptic coordinates are used to compensate unwanted movement of the patient associated with the physical strain to reach the climax of the facial expression. In order to support the video stabilization with elliptic coordinates a new set of dynamic facial markers was introduced. Advantages and limitations of the new marker system and elliptic coordinates will be provided during the presentation.

This presentation will also provide a short overview of the challenges (lack of contrast between skin and lip color, complex background, asymmetric lip movement, specific disease pattern) in segmentation and tracking of the lips as well as some ideas and approaches to cope with these challenges.

**Multi-camera visual saliency**  
*(Majid Banaeyan) PhD*

This presentation introduces the topic my PhD thesis which is related to the INDIECAM company project. This company develops and manufactures high quality miniature action-cameras for filmmakers. The goal of this thesis is investigation of how information could be fused from multiple visual sources to provide a panoramic field of view with higher resolution. Additionally, some state-of-the-art studies and time scheduling will be discussed in the seminar.
**Smart Camera Image Stitching**  
*(Hanna Huber) MSc*

This presentation introduces the subject of my master’s thesis. It is part of a project initialized by the INDIECAM company which specializes in the production of film cameras. INDIECAM aims at parallelizing parts of the image stitching process by developing smart cameras that are able to perform image transformations. My master thesis’ goal is to develop a respective transformation model. In a multi-camera setup, cameras with overlapping views are considered. Each of them has the information about the other’s setup. Using this information, each camera should be able to predict for each image pixel the position of the corresponding pixel in another camera's image. At the seminar I will discuss current research, address open questions and propose a preliminary time schedule.

**Shape representation and classification using topology and local features**  
*(Ines Janusch) PhD*

A shape may be efficiently represented using Reeb graphs. However, these representations usually rely on clear foreground/background segmentation as their input. One aim therefore is to compute critical points that form the basis for graph representations, directly on the unsegmented data. Graph representations can then of course be used for shape classification. But small perturbations in the shape or changes of minor shape details may alter the topology of the graph. Thus, as an alternative a new shape descriptor using the persistence of LBP classes over a range of radii, is introduced.

These approaches of shape representation and classification are of course suitable for an application to spatio-temporal data and may for example be applied in tracking tasks in the future.

**Ellipse-based elongated shape representation**  
*(Aysylu Gabdulkhakova) PhD*

This talk presents two approaches related to the area of computer vision, where shape modelling (representation) is an essential part of every system. The developed methods deal with elongated round-ended shapes, and represent them with ellipses based on medial representation. The evaluation shows that the proposed approaches outperform the state-of-the-art techniques on the examined dataset.
Worm spawning behavior tracking
(Daniel Pucher) MSc

The goal of this project is to develop methods that enable 2D tracking of marine worms during spawning. These methods include the segmentation, tracking and calculation of descriptive features of the worms over time. The feature descriptions are used by researchers of the Max F. Perutz Laboratories GmbH to characterize and compare behaviors and include head positions, length, area, normalized shape and curvature of the worms. For the calculation of the curvature a new method based on discrete geometry is proposed. This project focuses on single worm tracking, as the tracking of two worms at the same time yields some problems that will be approached at a later time.

Automatic segmentation of knee cartilage in MRI using particle filters
(Patrick Valdellon) MSc

The aim of my master’s thesis is to automatically quantify the average intensity of knee cartilage volumes in 7 Tesla MRI. We are trying to implement an algorithm using particle filters. The particular challenges lie in the circular shape of the knee cartilage and the low contrast periphery. Inaccuracies in the segmentation of the volume have a big influence on the calculated average intensity value.

Localization and Tracking of Trains in Optical Time Domain Reflectometry (OTDR) Signals
(Adam Papp) MSc

Safety of railway operation by position and speed monitoring of trains is essential. Using optical time-domain reflectometry (OTDR) it is possible to detect vibration signals generated by trains in optical fiber cables that are buried nearby the railway track. The topic of this presentation and internship is to detect trains in OTDR signals using streaming algorithms. Furthermore, tracking of train movements in different conditions (e.g. bridges, tunnels or train velocity variation) will be investigated.

Background modeling of a video sequence
(Tomas Musil) BSc

The intention of my paper is the background modeling of a short video sequence. This means that a video that lasts for around 10 seconds will be analyzed and all objects which move around in the background will be classified as “disturbing objects”. Subsequently, these objects will not be considered during the background modeling. In this way, a picture will be produced that contains no moving objects. Therefore, the result will be one picture which solely shows the background of a scene.
Segmentation of Human Teeth Contours in Dental Radiographs Using Active Shape Models and Monogenic Features

(Michael Sprinzl) MSc

We present a framework for segmentation of human teeth contours in dental radiographs. As all humans share the same tooth structure, but show variation in size and morphology, these variations can be modeled using statistical methods.

Therefore we propose Active Shape Models (ASM) as segmentation approach. ASM are flexible, statistically based models which iteratively move toward structures in images similar to those on which they were trained in advance and consist of a set of corresponding landmarks. Each landmark represents a part of the tooth’s boundary to be located. The training phase of our proposed framework incorporates noise removal, manual segmentation of training images, solving the correspondence problem, aligning the set of training images, and capturing its statistics. For image interpretation, the model of the tooth is placed into the target image. The model parameters are then iteratively adjusted to move the landmarks closer to the contour of the tooth to be segmented. Constraints are applied so that the overall tooth shape to be segmented cannot deform more than the teeth seen in the corresponding training set. Our proposed framework is evaluated using a set of intra-oral dental radiographs containing 60 molars and 70 premolars from 24 patients (22 female, 2 male), taken over a period of ten years.