Image Processing and Low Level Vision

Course Description

Computer vision is generally understood as a subfield of artificial intelligence and is primarily concerned with developing and researching methods that enable computers to gain a high-level understanding of images or videos. This allows computers to perform high-level visual cognitive tasks, emulating or even surpassing the human capability to derive information from visual input. This course provides an exposition of the foundational aspects from the domain of image processing that underpin many of the more cognitive-oriented approaches of computer vision. Starting from an overview of image acquisition, the topic of image geometry is explored. Subsequently, common digital image representations are introduced together with some of the basic morphological operations that can be carried out on them. The course closes with an introduction to filtering and texture representation.

Contents

1. Image Acquisition
   1. The Human Visual System
   2. Cameras and Sensors
2. Single and Multi-View Geometry
   1. Camera Geometry and Perspective Projection
   2. Stereopsis and Multiple Views
3. Image Representation and Morphology
   1. Image Types
   2. Morphology of Binary and Greyscale Images
4. Filtering
   1. Filtering in the Spatial Domain
   2. Fourier Transformation and Filtering in the Frequency Domain
5. Texture
   1. Classical Texture Representations
   2. Bag of Words and Representation in CNNs