

17. ARTIFICIAL INTELLIGENCE AND SPATIAL-TEMPORAL SEMANTICS

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FOCUS OF THE LABORATORY

The lab mainly deals with intelligence problems related to sensory processing. As sensors have become miniaturized and ubiquitous in modern information technology, remotely processing all acquired data is not feasible any more. Remote does not necessarily refer to the cloud, but in this sense another processor, or even the other side of the same topographic processor, may also count as a remote location. Local processing requires appropriate knowledge and architectural organization. A key principle we developed is semantic embedding that refers to the process of injecting background information into the hierarchical recognition process at appropriate levels.

RESEARCH TOPICS

Scene understanding of 3D scenes

We consider 2D image flows containing the projection of 3D environments with other related information from other modalities. Specific scenes are described using a multimodal semantic language including spatiotemporal events, signatures of canonical views of typical objects, as well as spatial relationships of the objects and/or events. Semantic embedding during the recognition process is built on the knowledge in this representation.

The most important applications are autonomous local navigation and orientation tasks, either for personal or robot navigation. We developed a mobile framework for cell phones that serves as a basis for a guide helping blind and visually impaired people in their daily tasks.



Visual learning

Recognizing objects in a visual environment is a nontrivial task mainly because of the huge number of looks (imprints) how an object can be perceived from different viewpoints under various lighting conditions. Visual learning aims to find characteristic signatures (features and feature groups) that are invariant to rotation across multiple scales and adaptive clustering methods that are able to identify which signatures belong to the same, and which ones to different semantic categories.

Offline handwriting recognition

Recognition of handwritten cursive scripts is a much more difficult task than optical character recognition. The latter already has widespread commercial solutions, but the former is still an actively researched area. The main difference between the two fields is besides the fact that letter shapes greatly depend on individual writers is that touching characters pose a much more complex recognition scheme due to their ambiguous separation borders.

Semantic embedding is realized through a holistic word recognition technique that detects features on the word level without binding them to characters and a special linguistic engine that can find all proper linguistic forms that match a given holistic description.

PUBLICATIONS

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- [6] K. Karacs, G. Prószéky, and T. Roska CNN algorithms with spatial semantic embedding for handwritten text recognition, *International Journal of Circuit Theory and Applications*, vol. 37, no. 10, pp. 1019–1050, 2009