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Automatic Object Recognition

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Introduction

Automatic object recognition (AOR) is a challenging field which has been evolving over decades. The application areas span many domains such as robotics inspection, medical imaging, military targeting, and reconnaissance. Some of the most concentrated efforts in AOR have been in the military domain, where most of the problems deal with recognition of targets and scene analysis in the outdoors using a variety of sensors; the papers presented in this Institute were consequently more focused on military applications. However, the progress reported in the papers goes beyond their military domain and has unquestionably a variety of other applications.

In this SPIE Institute we gathered some expert and well-informed individuals on the subject of AOR and discussed some of the advances, issues, and trends in the field. The papers, as well as the discussions during the Institute, focused on many subjects, including model-based approaches, modeling, evaluation, neural networks, real-time systems, and technology evolution.

AOR techniques initially relied on statistical pattern recognition methods, which have shown their limitations. Artificial intelligence techniques have been widely investigated and have shown to be promising. Neural-network applications have also been emerging and have shown some promise. During the Institute, neural-net applications were discussed with the emphasis on their effectiveness in solving vision problems. Model-based object recognition appears to be one of the most promising paradigms, and it is the focus of attention of many researchers in the field. During the Institute, the model-based paradigm provoked many interesting discussions and challenging questions about the general problem of machine vision.

Among the most challenging issues in model-based recognition has been object modeling and the phenomenology of the scene, which were also widely discussed topics. Phenomenology studies have proven to be extremely critical, especially in certain sensor domains such as infrared, where the object signature can significantly vary because of the environment and object-state parameters. Because phenomenology studies have transformed AOR discipline from an art to a near-science, researchers are now looking more closely at the fundamental physical laws behind a given object signature. AOR system and algorithm evaluation has been another area of active research and development. Evaluation of AOR systems has proven to be a complex task due to the complexity and enormous variation of the signal/image data, among many other reasons. The evaluation topic was also discussed, especially in its relation to robust systems development.

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