Computer Vision Research at Marshall Space Flight Center

Frank L. Vinz

Marshall Space Flight Center

Orbital docking, inspection, and servicing are operations which have the potential for capability enhancement as well as cost reduction for space operations by the application of computer vision technology. Research at MSFC has been a natural outgrowth of orbital docking simulations for remote manually controlled vehicles such as the Teleoperator Retrieval System and the Orbital Maneuvering Vehicle (OMV). Baseline design of the OMV dictates teleoperator control from a ground station. This necessitates a high data-rate communication network and results in several seconds of time delay. Operational costs and vehicle control difficulties could be alleviated by an autonomous or semi-autonomous control system onboard the OMV which would be based on a computer vision system having capability to recognize video images in real time. A concept under development at MSFC with these attributes is based on syntactic pattern recognition. It uses tree graphs for rapid recognition of binary images of known orbiting target vehicles. This technique and others being investigated at MSFC will be evaluated in realistic conditions by the use of MSFC orbital docking simulators.

Computer vision is also being applied at MSFC as part of the supporting development for Work Package One of Space Station Freedom. The objective of this is to automate routine tasks such as locating, fetching, storing, adjusting, or monitoring experiments, thereby relieving crewmen for more demanding tasks. This vision system would be used in conjunction with a robot arm planned for use in the laboratory module. This vision system would also relieve accuracy requirements for instrumentation of arm positioning. One approach for this has been contracted to researchers at the University of Alabama in Huntsville who are developing a real-time expert vision system. This expert system uses knowledge to achieve a high performance level at every stage of an image-to-decision paradigm.