GUEST EDITORIAL

Special Section on Machine Vision for Industrial Inspection

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In this special section we have the opportunity to explore the science and technology of image processing and scene analysis as applied to the field of machine vision. Machine vision can be described as the integration of sensors and optics, computers, algorithms, and robotics to automate manufacturing inspection and characterization for quality and process control. The evolution and availability of inexpensive and powerful computers has contributed to the rapid growth and application of computer vision to address issues of industrial automation leading to increased productivity and product quality. Improving the yield of manufactured products, be it continuously formed paper or discrete semiconductor devices, also results in a reduction in lost products, product rework, energy consumption, and the mitigation of chemical and solid waste streams.

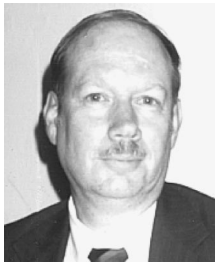
Although a general call for papers was advertised through several channels at SPIE, a majority of the papers in this special section were solicited from two conferences that deal primarily with industrial applications of computer vision: from Photonics West the conference on Machine Vision Applications in Industrial Inspection, and from Photonics East the conference on Machine Vision and Three-Dimensional Imaging Systems for Inspection and Metrology. Despite the location of these conferences within the East and West coasts of the United States, the papers herein represent the work of researchers from around the world such as France, Germany, Mexico, Switzerland, and the United Kingdom—an indication of the global extent of machine vision as a ubiquitous tool of modern manufacturing and a fertile area for research and development.

This special section has been subdivided into five topical areas. The first of these is Image Understanding and Scene Analysis. Papers in this area deal with issues of the imaging of specular surfaces, image segmentation, super-resolution, and color imaging. The second topical area is Image-based Metrology. Papers in this area represent interferometric methods, subpixel edge detection, and shearography. The third topic is Surface and 3D Imaging with papers describing range imaging, interferometric surface techniques, and 3D interpolation. The successful incorporation of 3D and surface techniques into application areas such as industry and medicine are becoming much more prevalent as computing power and memory continues to increase at a cost-effective rate. The fourth topic is Industrial Applications. This applications area could just as easily have been titled ''from metallurgy to ichthyology'' (this will undoubtedly become clear upon reading). And finally, the last topic is Imaging Architectures. The architectures described in this section are both hard and soft, ranging from FPGA designs for computer vision to a web-based approach to the remote design of machine vision systems.

While these papers are representative of only a small sampling of the many topics related to computer vision, they do touch on several broad application areas and will hopefully enlighten the reader not only regarding work underway, but on the work left to be done.

Kenneth W. Tobin leads the Image Science and Machine Vision Group at the Oak Ridge National Laboratory, Oak Ridge, Tennessee. His technical research includes scene analysis and pattern recognition for machine vision as applied to industrial real-time, high-speed inspection and automation problems. Over the past nine years, Dr. Tobin has helped to establish three programs in electronic imaging in the areas of Industrial Inspection, Biomedical Imaging, and National Security. He has authored and coauthored over 90 technical publications in the fields of electronic imaging, signal and image processing, and pattern recognition. He currently holds three U.S. patents with three additional patents pending in the areas of computer vision and photonics. Dr. Tobin is a member of the Institute of Electrical and Electronics Engineers (IEEE) and the International Society for Optical Engineering (SPIE) where he is currently serving as the SPIE program co-chair for Microengineering/Manufacturing

and the conference chair for Metrology-based Control for Micromanufacturing. He also serves as co-chair of the Scientific Committee for the IEEE Conference on Quality Control by Artificial Vision, and as a technical committee member of the SPIE Conference on Machine Vision Applications in Industrial Inspection. Dr. Tobin received his PhD in nuclear engineering from the University of Virginia, Charlottesville, Virginia, and an MS in nuclear engineering and a BS in physics from Virginia Tech, Blacksburg, Virginia.



John W. V. Miller received his MSEE and PhD from the University of Toledo in 1971 and 1983, respectively. He was employed by Owens Illinois from 1968 until 1987 where he worked on the development of ac plasma panels initially until 1976 after which he developed machine vision systems for glass inspection. In 1987 he joined the faculty of The University of Michigan—Dearborn as an associate professor. He is a member of Tau Beta Pi, Eta Kappa Nu, and Sigma Xi and holds 25 US patents in the areas of machine vision and plasma panel display devices. Dr. Miller has served as a co-chair of the SPIE Machine Vision Applications, Architectures, and Systems Integration program committee. His research interests include machine vision, image processing, and multimedia applications.