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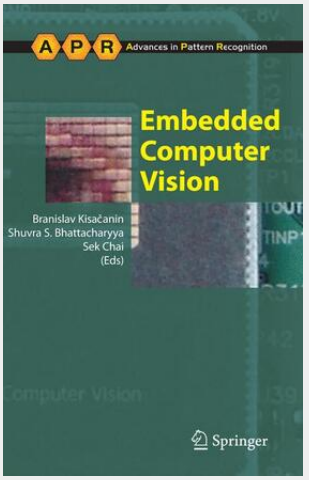
Embedded Computer Vision



As a graduate student at Ohio State in the mid-1970s, I inherited a unique c- puter vision laboratory from the doctoral research of previous students. They had designed and built an early frame-grabber to deliver digitized color video from a (very large) electronic video camera on a tripod to a mini-computer (sic) with a (huge!) disk drive—about the size of four washing machines. They had also - signed a binary image array processor and programming language, complete with a user's guide, to facilitate designing software for this one-of-a-kindprocessor. The overall system enabled programmable real-time image processing at video rate for many operations. I had the whole lab to myself. I designed software that detected an object in the eldofview,trackeditsmovementsinrealtime,anddisplayedarunningdescription of the events in English. For example: "An object has appeared in the upper right corner.Itismovingdownandtotheleft.Nowtheobjectisgettingcloser.The object moved out of sight to the left"—about like that. The algorithms were simple, relying on a suf cient image intensity difference to separate the object from the background (a plain wall). From computer vision papers I had read, I knew that vision in general imaging conditions is much more sophisticated. But it worked, it was great fun, and I was hooked.

Embedded Computer Vision, exemplified by the migration from powerful workstations to embedded processors in computer vision applications, is a new and emerging field that enables an associated shift in application development and implementation. This comprehensive volume brings together a wealth of experiences from leading researchers in the field of embedded computer vision, from both academic and industrial research centers, and covers a broad range of challenges and trade-offs brought about by this paradigm shift. Part I provides an exposition of basic issues and applications in the area necessary for understanding the present and future work. Part II offers chapters based on the most recent research and results. Finally, the last part looks ahead, providing a sense of what major applications could be expected in the near future, describing challenges in mobile environments, video analytics, and automotive safety applications. Features: • Discusses the latest state-of-the-art techniques in embedded computer vision • Presents a thorough introductory section on hardware and architectures, design methodologies, and video analytics to aid the reader's understanding through the following chapters • Offers emphasis on tackling important problems for society, safety, security, health, mobility, connectivity, and energy efficiency • Discusses evaluation of trade-offs required to design cost-effective systems for successful products • Explores the advantages of various architectures, development of high-level software frameworks and cost-effective algorithmic alternatives • Examines issues of implementation on fixed-point processors, presented through an example of an automotive safety application • Offers insights from leaders in the field on what future applications will be This book is a welcome collection of stand-alone articles, ideal for researchers, practitioners, and graduate students. It provides historical perspective, the latest research results, and a vision for future developments in the emerging field of embedded computer vision. Supplementary material can be found at http://www.embeddedvisioncentral.com.

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