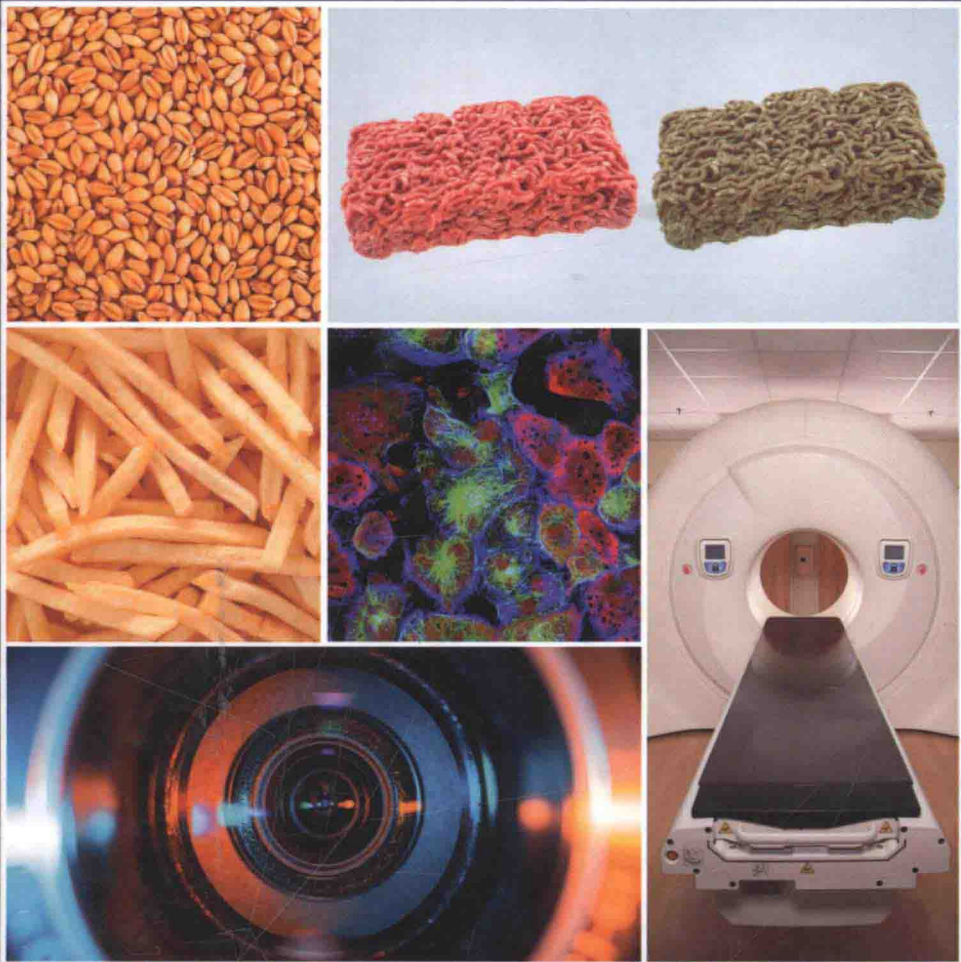




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Bio-Imaging

Principles, Techniques,
and Applications



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and Applications

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Dedicated to our spouses:

Mrs. Manju Jayas

Mr. Natarajan Thiagarajan

Preface

Human beings are blessed with senses to observe objects and make decisions about the type and quality of objects, but their decisions can be affected by fatigue, improper lighting conditions, lack of experience, or a combination of these. On the other hand they are not so blessed when they are inflicted by diseases and require diagnostic tools to detect and identify these diseases. Digital image processing with associated sensing elements operating in the broad range of the electromagnetic spectrum has emerged as a prominent technique in almost every field for making such decisions. Although the imaging technique originated more than a century ago, tremendous growth has been seen in the last two decades, especially with growth in the hardware and software industries providing a significant boost. Imaging is a broad term that encompasses a variety of techniques focused on different types of imaging. Imaging was originally developed for applications in the medical field and remote sensing. As technology grew, the technique has occupied an irreplaceable part in every walk of life.

The term *bio-imaging* refers to imaging of biological materials, which are the basis of the food and agriculture, health, aquaculture, forestry, and environmental industries. New technology originally invented for applications in other industries is gradually adopted by the food and agriculture industry.

Imaging includes various types of techniques from simple imaging in the visible spectrum to other regions of the electromagnetic spectrum such as X-ray, thermal, and hyperspectral imaging. In the food and agriculture industry, automation of various processing operations has occurred to a large extent and automation based on imaging is the latest trend. The idea for this book sprouted when we realized a need to gather together the principles and applications of various imaging techniques in the food and agriculture industry. Some of the imaging techniques are commercially available, whereas others are in the research phase. Research studies on the potential of imaging in food- and agriculture-related applications are published in international journals and many techniques are being further developed to meet the growing demands of the industry. This book provides a collection of various imaging techniques, their working principles, and their applications in the food, agriculture, and some bio-medical sectors.

The first chapter deals with introduction and the need for biological imaging. The second chapter discusses various image acquisition and processing techniques, and the third chapter elaborates on classification techniques. From the fourth chapter onward the discussion is of an imaging technique and its applications based on the food and agriculture industry. A summary of most of the imaging-based research work in the food and agriculture industry is discussed in the applications section of each chapter along with the advantages and limitations of every technique. The concluding chapter summarizes imaging-based automation techniques with the focus on the current trends and the future of imaging in the food and agricultural sector.

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Our sincere thanks to David Fausel, project coordinator, and Michael Slaughter, acquiring editor, at CRC Press/Taylor & Francis Group for agreeing to publish our work and guiding us through the process of publication.

A considerable amount of preparation of this book was done during travels by Digvir S. Jayas on Air Canada flights. He sincerely thanks Air Canada, its flight attendants and concierges, in general, but concierges in Winnipeg, namely, Don Boulet, Sarah Hardy, Conrad Hill, Janice Hudson, Glenn Rusnak, and John Ticzon, for their assistance in making his flights very comfortable with the perfect working environment during the flights and in the Maple Leaf lounges. Their pleasant personalities and willingness to accommodate his requests for changes and the best seats are gratefully acknowledged.

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