

## Multi-resolution Image Fusion in Remote Sensing

The text offers discussion on tools and techniques of multi-resolution image fusion with necessary mathematical background. It covers important multi-resolution fusion concepts along with state-of-the-art methods including super-resolution and multistage guided filters. It includes in-depth analysis on degradation estimation, Gabor prior and Markov Random Field (MRF) prior. The use of edge-preserving filters in multi-resolution fusion is highlighted. The techniques of compressive sensing and super-resolution are explained for the benefit of readers. Fusion methods are presented using spatial and transform domains in addition to model based fusion approaches. Real life applications and plenty of multi-resolution images are provided in the text for enhanced learning.

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*To*

*Smita, Nidhi and Ninad*  
— *MVJ*

*Dipika, Taksh and Tithi*  
— *KPU*



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## Preface

It is always interesting to visualize the content of a scene with high spatial and spectral resolutions. However, constraints such as the trade-off between high spatial and spectral resolutions of the sensor, channel bandwidth, and on-board storage capability of a satellite system place limitations on capturing images having high spectral and spatial resolutions. Due to this, many commercial remote sensing satellites such as Quickbird, Ikonos, and Worldview-2 capture the earth's information with two types of images: a single panchromatic (Pan) and a number of multispectral (MS) images. Pan has high spatial resolution with lower spectral resolution, while MS image has higher spectral resolving capability with low spatial resolution. An image with high spatial and spectral resolutions, i.e., a fused image of MS and Pan data can lead to better land classification, map updating, soil analysis, feature extraction, etc. Also, since fused image increases the spatial resolution of the MS image, it results in sharpening the image content which makes it easy to obtain greater details of the classified maps. The *multi-resolution image fusion or pan-sharpening* is an algorithmic approach to increase the spatial resolution of the MS image, while preserving spectral contents by making use of the high spatial resolution Pan image. This book is an attempt to present the state-of-the-art in current research on this topic.

The book covers the recent advances in research in the area of multi-resolution image fusion. Different fusion methods are presented using spatial and transform domains, in addition to model based fusion approaches. We extend our model based fusion work to super-resolution of the natural images, which is one of the important areas of research in the field of computer vision. The book also includes comprehensive literature review on multi-resolution image fusion techniques.

The book is addressed to an audience including, but not limited to, academicians, practitioners, and industrial researchers, working on various fusion applications, and project managers requiring an overview of the on-going research in the field of multi-resolution image fusion. The topics discussed in this book have been covered with sufficient detail and we have also illustrated them with a large number of figures for better understanding. Finally, much of the material would be of value for post-graduate and doctorate level students who attend related courses or are engaged in research in multi-resolution image fusion and related fields.

We look forward to comments or suggestions from the readers.





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