Super Resolution Image Reconstruction Matlab Code

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Super Resolution Image Reconstruction Matlab
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This book is devoted to the issue of image super-resolution—obtaining high-resolution images from single or multiple low-resolution images. Although there are numerous algorithms available for image interpolation and super-resolution, there's been a need for a book that establishes a common thread between the two processes. Filling this need, Image Super-Resolution and Applications presents image interpolation as a building block in the super-resolution reconstruction process. Instead of approaching image interpolation as either a polynomial-based problem or an inverse problem, this book breaks the mold and compares and contrasts the two approaches. It presents two directions for image super-resolution: super-resolution with a priori information and blind super-resolution reconstruction of images. It also devotes chapters to the two complementary steps used to obtain high-resolution images: image registration and image fusion. Details techniques for color image interpolation and interpolation for pattern recognition Analyzes image interpolation as an inverse problem Presents image registration methodologies Considers image fusion and its application in image super resolution Includes simulation experiments along with the required MATLAB® code Supplying complete coverage of image-super resolution and its applications, the book illustrates applications for image interpolation and super-resolution in medical and satellite image processing. It uses MATLAB® programs to present various techniques, including polynomial image interpolation and adaptive polynomial image interpolation. MATLAB codes for most of the simulation experiments supplied in the book are included in the appendix.

This dissertation, "Super Resolution Technique and Its Potential Usage in Medical Imaging" by Yiu-chuen, Chang, □□□, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Purpose: Medical imaging systems are used to scan patients to obtain valuable information for diseases diagnosis and assisting treatment. An ideal scanner should be sensitive enough to detect any trace amount of abnormal tissue at its early stage. With the continuous development of high-tech treatment systems such as Tomotherapy (manufactured by Tomo HD), the high-resolution imaging system is favorable to reduce the damage of normal tissue due to the image guidance of Mega-voltage beam before treatment. In this study, a software approach was presented to improve image resolution without hardware upgrade of a scanner. Methodology A programming technique "Super Resolution Technique" was used and demonstrated in an example of CT. It utilized several similar images with known relative shifts between them. (They can be positional or angular shifted and taken at the same time frame as far as possible). Those images are of low resolution and can be reconstructed to form a higher resolution image. A Super Resolution program was written by MATLAB to prove the method. The experiments 1 to 4 were purely computer-based simulations and experiment 5 used a LightSpeed VCT scanner for real scans. For the computer-based experiments, a few low resolution images have been attempted and registration steps were explored for image reconstruction. A resolution target, USAF1951, was called from MATLAB and used to examine the resolving power before and after image processing based on Super Resolution algorithm. Image-image subtraction was used to compare pre-processing and post-processing images. The number of non-zero pixels was used to access the percentage of similarity. For the experiment using LightSpeed VCT scanner, a GE VCT QA phantom was used to test the performance of the technique. Result From the experiments using USAF1951, it was found that: the minimum resolvable line pairs had improved from family -1 element 6 to family 0 element 2 (2 elements improvement) after applying "Super Resolution Technique" as shown in the experiment 1. An xy directional shifting of the pre-processing images resulted in a better reconstructed image than x-axis shifting or y-axis shifting in terms of resolution, shown in the experiment 2. The experiment 3 concluded that the more the pre-processing images, the better the reconstructed image would be. The experiment 4 showed that the shifts of pre-processing images greater than the detector size could still

result in a higher resolution image. The experiment 5 revealed that applying "Super Resolution Technique" to a real CT scanner could not give an obvious improvement in resolution, but the image background noise had reduced. Conclusion It was concluded that the "Super Resolution Technique" could improve the image resolution and reduce the background noise at expense of more imaging time and more dose from the additional view. In case of hardware upgrade of imaging device is not practicable, Super Resolution could help improve the image quality. DOI: 10.5353/th_b5204647 Subjects: Diagnostic imaging

To my wife, Mitu - Vivek Bannore Preface Preface In many imaging systems, under-sampling and aliasing occurs frequently leading to degradation of image quality. Due to the limited number of sensors available on the digital cameras, the quality of images captured is also limited. Factors such as optical or atmospheric blur and sensor noise can also contribute further to the d- radation of image quality. Super-Resolution is an image reconstruction technique that enhances a sequence of low-resolution images or video frames by increasing the spatial resolution of the images. Each of these low-resolution images contain only incomplete scene information and are geometrically warped, aliased, and - der-sampled. Super-resolution technique intelligently fuses the incomplete scene information from several consecutive low-resolution frames to reconstruct a hi- resolution representation of the original scene. In the last decade, with the advent of new technologies in both civil and mi- tary domain, more computer vision applications are being developed with a demand for high-quality high-resolution images. In fact, the demand for high- resolution images is exponentially increasing and the camera manufacturing te- nology is unable to cope up due to cost efficiency and other practical reasons.

Regularization becomes an integral part of the reconstruction process in accelerated parallel magnetic resonance imaging (pMRI) due to the need for utilizing the most discriminative information in the form of parsimonious models to generate high quality images with reduced noise and artifacts. Apart from providing a detailed overview and implementation details of various pMRI reconstruction methods, Regularized image reconstruction in parallel MRI with MATLAB examples interprets regularized image reconstruction in pMRI as a means to effectively control the balance between two specific types of error signals to either improve the accuracy in estimation of missing samples, or speed up the estimation process. The first type corresponds to the modeling error between acquired and their estimated values. The second type arises due to the perturbation of k-space values in autocalibration methods or sparse approximation in the compressed sensing based reconstruction model. Features: Provides details for optimizing regularization parameters in each type of reconstruction. Presents comparison of regularization approaches for each type of pMRI reconstruction. Includes discussion of case studies using clinically acquired data. MATLAB codes are provided for each reconstruction type. Contains method-wise description of adapting regularization to optimize speed and accuracy. This book serves as a reference material for researchers and students involved in development of pMRI reconstruction methods. Industry practitioners concerned with how to apply regularization in pMRI reconstruction will find this book most useful.

With the exponential increase in computing power and broad proliferation of digital cameras, super-resolution imaging is poised to become the next "killer app." The growing interest in this technology has manifested itself in an explosion of literature on the subject. Super-Resolution Imaging consolidates key recent research contributions from eminent scholars and practitioners in this area and serves as a starting point for exploration into the state of the art in the field. It describes the latest in both theoretical and practical aspects of direct relevance to academia and industry, providing a base of understanding for future progress. Features downloadable tools to supplement material found in the book Recent advances in camera sensor technology have led to an increasingly larger number of pixels being crammed into ever-smaller spaces. This has resulted in an overall decline in the visual quality of recorded content, necessitating improvement of images through the use of post-processing. Providing a snapshot of the cutting edge in super-resolution imaging, this book focuses on methods and techniques to improve images and video beyond the capabilities of the sensors that acquired them. It covers: History and future directions of super-resolution imaging Locally adaptive processing methods versus globally optimal methods Modern techniques for motion estimation How to integrate robustness Bayesian statistical approaches Learning-based methods Applications in remote sensing and medicine Practical implementations and commercial products based on super-resolution The book concludes by concentrating on multidisciplinary applications of super-resolution for a variety of fields. It covers a wide range of super-resolution imaging implementation techniques, including variational, feature-based, multi-channel, learning-based, locally adaptive, and nonparametric methods. This versatile book can be used as the basis for short courses for engineers and scientists, or as part of graduate-level courses in image processing.

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How to Optimally Sample and Resample Images: Theory and Methods Using MATLAB provides updated formulations of image sampling theory and practical algorithms of image sampling with sampling rates close to the theoretical minimum, and also introduces interpolation error-free methods of image resampling. Readers will be informed about relevant principles and applications of image sampling with the help of MATLAB©. The information presented in the book, across 9 chapters, will help readers to understand processes that make analog to digital signal conversion efficient for modern imaging devices. Key Features: - Introduces readers to classical sampling theorems - Presents updated information about image sampling and resampling formulations with reference to theoretical minimums - Presents information on practical and fast sampling algorithms - Presents information about interpolation error-free methods of image resampling - Presents examples of applications of the described methods - Is supplemented by

a MATLAB© program package for exercising knowledge. The book is a suitable handbook for engineers and technicians involved in imaging engineering and related applications as well as engineering students learning about digital signal processing techniques.

Advanced Computing, Networking and Informatics are three distinct and mutually exclusive disciplines of knowledge with no apparent sharing/overlap among them. However, their convergence is observed in many real world applications, including cyber-security, internet banking, healthcare, sensor networks, cognitive radio, pervasive computing amidst many others. This two-volume proceedings explore the combined use of Advanced Computing and Informatics in the next generation wireless networks and security, signal and image processing, ontology and human-computer interfaces (HCI). The two volumes together include 148 scholarly papers, which have been accepted for presentation from over 640 submissions in the second International Conference on Advanced Computing, Networking and Informatics, 2014, held in Kolkata, India during June 24-26, 2014. The first volume includes innovative computing techniques and relevant research results in informatics with selective applications in pattern recognition, signal/image processing and HCI. The second volume on the other hand demonstrates the possible scope of the computing techniques and informatics in wireless communications, networking and security.

This book encompasses the full breadth of the super-resolution imaging field, representing modern techniques that exceed the traditional diffraction limit, thereby opening up new applications in biomedicine. It shows readers how to use the new tools to increase resolution in sub-nanometer-scale images of living cells and tissue, which leads to new information about molecules, pathways and dynamics. The book highlights the advantages and disadvantages of the techniques, and gives state-of-the-art examples of applications using microscopes currently available on the market. It covers key techniques such as stimulated emission depletion (STED), structured illumination microscopy (SSIM), photoactivated localization microscopy (PALM), and stochastic optical reconstruction microscopy (STORM). It will be a useful reference for biomedical researchers who want to work with super-resolution imaging, learn the proper technique for their application, and simultaneously obtain a solid footing in other techniques.

This book is a collection of proceedings of the International Conference on Mechatronics and Intelligent Robotics (ICMIR2018), held in Kunming, China during May 19–20, 2018. It consists of 155 papers, which have been categorized into 6 different sections: Intelligent Systems, Robotics, Intelligent Sensors & Actuators, Mechatronics, Computational Vision and Machine Learning, and Soft Computing. The volume covers the latest ideas and innovations both from the industrial and academic worlds, as well as shares the best practices in the fields of mechanical engineering, mechatronics, automatic control, IOT and its applications in industry, electrical engineering, finite element analysis and computational engineering. The volume covers key research outputs, which delivers a wealth of new ideas and food for thought to the readers.