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*Editorial*

# Medical Imaging and Image Processing

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Medical imaging (MI) [1] utilizes various technologies to produce images of the human body's internal structures and functions [2]. Healthcare professionals (HPs) [3] use these medical images for four purposes: diagnosis [4], treatment planning [5], monitoring [6], and research.

Firstly, the HPs utilize medical images to identify and diagnose medical conditions that may be complicated or impossible to spot without imaging. Secondly, medical images help HPs to plan and prepare for medical procedures. For example, computed tomography (CT) [7,8] scans assist HPs in planning radiation therapy for cancer patients by enabling the identification of the location and size of the tumor regions. Third, medical images have been used to monitor the progression of diseases over time. Finally, scientists can use medical images to study the anatomy and physiology of the human body [9] and investigate the effects of diseases and treatments on the body [10].

MI is now becoming essential in different biomedical research and clinical practice fields. Biologists study cells and generate 3D confocal microscopy data sets [11]. Neuroscientists detect regional metabolic brain activity from positron emission tomography (PET) [12,13], functional magnetic resonance imaging (fMRI), and magnetic resonance spectrum imaging (MRSI) [14] scans. Virologists generate 3D reconstructions of viruses from micrographs [15]. Radiologists can identify and quantify tumors from MRI and CT scans [16].

Additionally, MI includes several other techniques: X-rays, ultrasounds, nuclear medicine imaging (NMI), etc. X-ray scans [17] use X-rays to create images of bones. Ultrasounds employ sound waves to build images of internal organs. The NMI [18] uses a small amount of radioactive material to create images of the body's internal structures and functions, such as blood flow, metabolism, and organ function.

On the other hand, medical image processing remains a challenge for researchers. MIP roughly contains seven common tasks, as shown in Figure 1. Image acquisition involves acquiring medical images from various MI modalities such as X-rays, CT scans, MRI scans, and ultrasound scans. Preprocessing [19] helps to clean and enhance medical images by removing noise, correcting distortion, and enhancing contrast. Segmentation [20] separates the region of interest from the background and separates different structures within the image. Registration [21] aligns different medical images to create a composite image that provides a more comprehensive view of the anatomy and pathology. Feature extraction extracts important features from medical images, such as various structures' size, shape, texture, and intensity. Classification classifies different structures within medical images based on their features and properties. Visualization [22] builds visual representations of medical images in 2D or 3D to aid diagnosis, treatment planning, and research.

Firstly, MIP can be used to determine the diameter, volume, and vasculature of a tumor or organ [23], flow parameters of blood [24] or other fluids, and microscopic changes that have yet to raise any otherwise discernible flags. Secondly, MIP creates realistic

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simulations and models of the human body, which are used for medical education [25] and training purposes [26]. Thirdly, MIP provides real-time guidance and visualization during surgical procedures [27], allowing surgeons to navigate complex anatomical structures more effectively. Finally, MIP helps in crafting custom prosthetic devices [28], such as implants and orthotics [29], that are tailored to the patient's anatomy and needs.

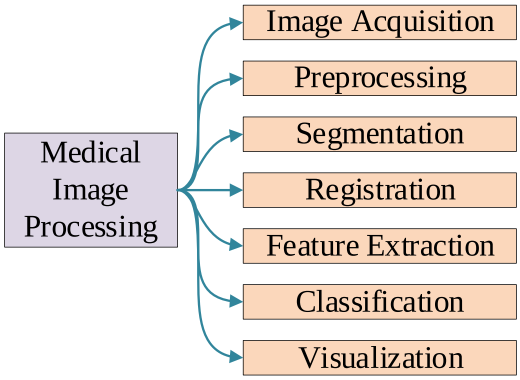


**Figure 1.** Seven common tasks in medical image processing.

Currently, MI and MIP entail several challenges [30], such as low-resolution quality, high-level noise, low contrast, geometric deformations, presence of artifacts [31], small-size dataset [32], large computational burdens [33], long training time, etc. In our previous successful Special Issues, 'Medical Imaging & Image Processing' in 2015 and 'Medical Imaging & Image Processing II' in 2018, the authors partially solved the aforementioned challenges and reported their research outputs.

In conclusion, we propose the third Special Issue in this series, 'Medical Imaging & Image Processing III', which aims to provide a diverse but complementary set of contributions to demonstrate new theoretical and technological developments and applications in medical imaging and image processing. All submissions will be thoroughly reviewed through a single-blind peer-review process.

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