

Call for Papers

IEEE Transactions on Medical Imaging

Special Issue on Imaging-based Diagnosis of COVID-19

Summary:

The outbreak of novel coronavirus 2019 (COVID-19) has rapidly spread to most countries in the world. To date (Mar 29th 2020), there have been 722,088 confirmed cases all around the world. This has led to a public health emergency of international concern, and put all health organizations on high alert. The current diagnosis of COVID-19 is based on real-time reverse-transcriptase polymerase chain reaction (RT-PCR), and regarded as the gold standard for confirmation of infection. However, the sensitivity of this diagnostic gold standard is lower, especially at the initial presentation of COVID-19. On the other hand, medical imaging, such as Computed Tomography (CT), Chest X-ray (CXR), and Ultrasound (US), plays a major role in confirming positive COVID-19 patients. For faster examination, techniques for automated infection measurement and COVID-19 diagnosis from imaging data, i.e., based on artificial intelligence (AI) with deep learning, have been developed, and some related software packages have been deployed in many hospitals in China and some other countries.

However, the development of this kind of practical AI diagnostic systems for epidemic response is very different from the development of traditional AI diagnostic systems due to at least three reasons. **1)** AI-based COVID-19 diagnostic systems need to be developed in days (instead of months or years), while initially the number of COVID-19 samples is small, thus not enough to train deep learning algorithms that often require a large number of training samples. **2)** Most deep learning algorithms also need a large number of manually-delineated samples (i.e., manually-delineated lung, lung lobes/segments, and infection regions), while collaborating physicians were extremely busy fighting with COVID-19 and thus had no time to help manual delineation. **3)** In the early stage, the diagnosis results of suspicious patients are also not accurate, especially using the initial tests of RT-PCR (used as golden standard), which will eventually affect the performance of AI systems that learn from provided samples with possible incorrect labels.

Topics of interest:

To address the above unique problems in diagnosis of COVID-19, various techniques need to be developed. This special issue focuses on novel imaging analysis techniques related to COVID-19, with some example topics listed below:

- **Pre-scan:** Camera-based automatic positioning to prevent technicians from close contact with patients, i.e., by using computer vision to identify important body landmarks for guiding imaging equipment
- **Segmentation** of lung, lung lobes, and infections, especially for cases with small training data in the early stage
- **Supervised or semi-supervised learning** for lung and infection segmentation
- **Fast manual delineation** of acquired imaging data, i.e., using human-in-loop technique
- **Diagnosis** of COVID-19 using extracted anatomical and infection **features**
- **Diagnosis** of COVID-19 based directly on **imaging data**
- **Diagnosis** of COVID-19 with **noisy** (or **incorrect**) labels in some training samples
- **Multi-task learning**, i.e., joint image segmentation and image-based diagnosis for COVID-19
- **Discriminating** between COVID-19 and community-acquired pneumonia based on CT images
- **Longitudinal registration** and **quantitative comparison** of images acquired from the same patient during the treatment, to evaluate the progress of COVID-19 in each patient
- **Early prediction** of COVID-19 progress, i.e., from mild to severe or critical
- **Severity assessment** of COVID-19 based on initial imaging scan(s)
- **Comparison of spatial infection patterns** between COVID-19 and community-acquired pneumonia
- **Building statistical atlases** for the spatial distribution of infections in COVID-19 population

Submission Process:

Submissions are accepted on a rolling basis until further notice. Authors must submit their papers electronically according to the instructions provided in <https://ieeetmi.org/authors/instructions.asp>. Please select *Special Issue on Imaging-based Diagnosis of COVID-19* as the *Type* at the first step of the manuscript submission process on ScholarOne. The first decision is made in less than four weeks, and the accepted manuscript is immediately published in early access.

This TMI special issue is in partnership with the Intelligent Analysis of COVID-19 Imaging Data Special Issue running in Medical Image Analysis (MedIA). To avoid overlap and ensure the joint special issue is complementary, authors should keep in mind that TMI will more emphasize on novel image analysis techniques for COVID-19 diagnosis. Note that papers describing

important applications based on medically adopted and/or established methods without significant innovation in methodology will be directed to other journals. Also, papers that publish data only are beyond the scope of TMI. Authors are encouraged to discuss with one of the Guest Editors to determine the suitability of their research for this special issue. Sharing the data after paper acceptance is strongly encouraged.

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