Personal Statement

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Applicant for the Ph.D. program in Biomedical Engineering

I am currently a third-year master's student majoring in Electronics and Information. Before that, I received my bachelor's degree in Biomedical Engineering in June 2020. My research interest lies in artificial intelligence for medical image computing. ~~During my undergraduate and postgraduate studies,~~ I have been actively engaged in research projects, including neuroimage analysis, disease detection, children's hormone level prediction, and medical image segmentation during my undergraduate and postgraduate studies. ~~With a strong interest in the truly interdisciplinary research in Biomedical Engineering and an aspiration to becoming a senior scientist in the area of medical image computing,~~ I ~~am excited~~ intend to ~~apply for the~~ earn a Ph.D. degree ~~program~~ in ~~the Department of~~ Biomedical Engineering at Rensselaer Polytechnic Institue to begin a career as an academic endeavoring to create novel techniques that push the frontiers of medical image computing. Moreover, I plan to work part-time as a senior scientist in industry to develop precise, automated medical image computing applications that will facilitate and make affordable clinical procedures, such as disease screening, diagnosis, and surgery, to improve the health of people, particularly those in third world countries~~, where I can continue my research with help from strong academics~~. ~~I believe meaningful innovations in this area are of fundamental importance to improve clinical practice.~~

As an undergraduate student, I was fortunate to join the lab led by Prof. Bingsheng Huang in 2017 and participated in an interdisciplinary research project, where knowledge of computational informatics, medical imaging, and neuroscience intersects to explore a question—how structural changes in magnetic resonance imaging (MRI) relate to the treatment response of herpes zoster patients. Our group applied for funding to support the project and completed it with multiple outputs, including one journal paper appearing in Frontiers in Neuroscience, two patents, and one software copyright. During the project, I first learned how to curate medical imaging datasets and write computer programs in MATLAB to analyze data. This valuable initial experience developed my ability to define a research question and solve unpredictable problems when advancing a project. It also made me realize how interesting solving unexplored problems is and encouraged me to move forwards.

I started independently undertaking research projects in 2018, the third year of my bachelor's studies. Under the direction of Prof. Bingsheng Huang, the first project I led collaborates with medical imaging specialists in Shenzhen Children's Hospital. The project aims to predict short-stature children's growth hormone levels based on the radiomics features of pituitary glands in MRI to circumvent the fearsome blood test. After several months of hard work in creating novel algorithms, prototyping predictive computer programs in Python, and designing a graphical user interface, the project won the third prize in a national biomedical engineering competition. I led the second project when I was an intern at the Department of Radiology in Guangzhou Panyu Central Hospital. Witnessing the heavy workloads of radiologists in China firsthand, I set out to develop a computer-assisted tool for hepatocellular carcinoma detection in computed tomography in order to facilitate

cancer diagnosis. This project was written in my undergraduate final year thesis and rated a high score by the thesis defense committee.

Through the experiences above, I built up a sense of leadership and more importantly ambition to produce top-notch publications in medical image computing. In the first year of my master's studies, under Prof. Yi Wang's guidance, I authored and submitted a manuscript to MICCAI 2020, which tackles the problem of misclassification in deep learning-based volumetric organ segmentation. Unfortunately, research is not a straight line to me. My paper was not accepted by the conference. But as a person who does not give up easily, I meticulously improved my manuscript, which finally made it to CBMS 2022. Besides, an extended journal version was submitted to Expert Systems With Applications. Now, looking back on this adversity, I am sure that it is rather precious. Detours and mistakes are time well spent, which not just teach me how to produce work that is valuable to the medical image computing community, but also empower me to face risks and uncertainty that are always associated with research.

With skills in writing clear, organized articles and knowledge of deep learning and image segmentation learned during the first authorship, I challenge myself to work on more complicated problems. I took up the problem of scribble-supervised learning for medical image segmentation. After making efforts in reviewing the literature, argumentation, experiments, and writing, I introduced a simple yet effective approach to address the problem utilizing the cluster assumption in semi-supervised learning and consistency training. We submitted the research manuscript to Medical Image Analysis, wherein we argue against and for recent studies, give a rationale for our design choices, and more importantly discuss our understanding of experimental results. Completing the project has cultivated my ability to critically judge studies in the field and my acumen to dig out prospective research directions. Besides, upon its completion, I felt a sense of achievement brought by contributing knowledge to the community. This feeling has greatly motivated me to continue my research in the field.

I am applying to the Ph.D. program in the Department of Biomedical Engineering at Rensselaer Polytechnic Institute because it can offer me an opportunity to collaborate with many impactful academic faculty. There are research groups at Rensselaer whose areas of research are particularly appealing to me. The Deep Imaging Analytics Lab (DIAL) under the direction of Dr. Pingkun Yan has similar research interests to mine. I admire DIAL's dedication and commitment to making meaningful innovations in two areas. One is the development of novel techniques for medical image computing, such as image registration, image segmentation, and region-of-interest detection. The other area is the application of these techniques in clinical procedures, such as MRI-TRUS fusion-guided prostate cancer biopsy and treatment, analysis of cancer screening images, and planning of maxillofacial surgeries. I believe that DIAL's innovation and focus will push the frontiers of medical image computing and solve challenges to meet clinical needs and would like to join their group. The AI-based X-ray Imaging System (AXIS) lab under the direction of Dr. Ge Wang has output established research in X-ray computed tomography and is still producing cutting-edge research that pioneers academic and industrial communities. I adore AXIS's recent study published in Nature Machine Intelligence prospecting metaverse for intelligent healthcare, for example, computational avatars for the Virtual Imaging Clinical Trial for Regulatory Evaluation (VICTRE). Overall, I

believe RPI's strong academic faculty, abundant resources, and collaborative environment can provide me with valuable guidance for my academic career.