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| **TO WHOM IT MAY CONCERN** |  |

Oakville, 2022/Jan/06

**Reference for Mr. Bingxu Hu**

Dear Sir or Madam,

Mr. Bingxu Hu worked as a graduate research assistant under my supervision in the Department of Geography and Environment at the University of Waterloo, Ontario, Canada from Sep 2020- June 2021 working on multi-temporal semantic change detection for automatic land cover change detection and classification from a multi-temporal, multi-resolution and multi-spectral imagery perspective. Mr. Bingxu’s work focused on investigating deep segmentation models and building topologically aware convolution networks for segmentation and transformers for image recognition at scale. He stands out in the group, for his exceptional modeling and implementation skills using advanced python/pytorch deep learning programming skills. I would place him among the top 2% research candidates I have ever trained in my career. His scientific and entrepreneurial skills have always amazed us with quick witted solutions with exceptional out-of-the-box thinking to offer novel approaches to the problem at hand. Due to his exceptional aptitude and skills, I had been encouraging him to convert his existing post-graduate program to doctoral program in the area of remote sensing.

Over the course of the year, he has successfully contributed to investigating and implementing topology aware fully convolutional networks for image segmentation employing multi-region interactions and adding hierarchical relations between region labels to minimize loss in hierarchical label relations and minimizing pairwise penalties. A noted testimony of his scientific and entrepreneurial acumen and interest is to proactively engage with his research partners where he actively contributed and supported existing Ph.D. students in solving some of their challenges.

His research on algorithms for “critical thinking” in deep learning models has resulted in improving the efficiency of learning process, performance and classification for feature recognition of remote sensing imagery. He aims to apply these state-of-the-art algorithms across various application areas of computer vision notably medical imaging and diagnosis. Widespread use of convolutional network architectures across remote sensing and medical imaging enables Mr.Bingxu to apply his competency to build deep learning imaging models for disease diagnostics. In view of current covid-19 pandemic, it is more pressing urgency to employ state-of-the-art deep-learning models for disease diagnostics.

In light of the above contributions to the state-of-the-art. I would strongly recommend Mr.Bingxu for doctoral position in SYDE focusing on biomedical engineering bearing in mind the fact that his exceptional academic accomplishments, perseverance, analytical and problem-solving skills would help him in delivering the state-of-the-art research in the field of biomedical engineering.

Yours sincerely,

**Awase Khirni Syed, Ph.D (University of Zurich,Swiss)**

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