Ministry of Science and ICT

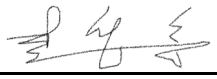
IITP Institute of Information & Communications Technology Planning & Evaluation

APPLICATION FORM
(JOINT RESEARCH)
HIGH POTENTIAL INDIVIDUALS GLOBAL TRAINING PROGRAM)

AGREEMENT

As stated above, I submit this application form to IITP that conducts "High Potential Individuals Global Training Program" supported by Ministry of Science, ICT in South Korea. IITP may disclose the information below to the public for the purpose of providing information and matching a research partnership between your institute and a Korean university.

* IITP : Institute for Information & communications Technology Planning & Evaluation

Printed Name of Chief of Research	Sanghoon Lee	Date(mm-dd-yyyy)	01/27/2020
Signature of Chief of Research			

☞ ***(Note)*** *This application is to identify the willingness to participate in this research and to find a research partnership for research institutes in Korea. Therefore, in its sole discretion, it is acceptable to contain only minimal information. (max. 3 pages)*

1. Research Title	Development of Web-based Artificial Intelligence Tool for Whole-Slide Imaging Analysis						
2. Research Area	**A.I.**	**Big Data**	**Cloud Computing**	**Block Chain**	**AR/ VR**	**ICT/SW Convergence**	**Other ICT /SW**
	X	**X**					
3. Chief of research	Title	Assistant Professor		Contact	E-mail: leesan@marshall.edu		
	Name	Sanghoon Lee			Tel: +1-304-696-6494		
4. Affiliation	Name	Marshall University		Classification	(X) University ( ) Research Institute ( ) Industry ( ) ETC.		
5. Capacity for students (5 or less)	2		**Support for students** ***(all necessary)***		(X) Visa support (X) Research Mentoring (X) Research Space (X) Accessibility to Research equipment		

6. Research Objective	**Objective 1. Create new annotation strategies to improve diagnostic accuracy and to minimize the burden of the annotation procedure in whole-slide imaging analysis.** We will investigate how the combinations of auto encoder (AE) with unsupervised machine learning methods can improve the identification and extraction of hundreds-of-millions of histologic structures in whole-slide images. We will also validate the efficiency of the annotation-free strategies in immune-histological analysis of tumor-infiltrating lymphocytes. **Objective 2. Develop a web-based software to enable domain experts to fully utilize the proposed method and lead them into a better decision-making.** Designing and implementing a web-based software will provide broad access to the entire biomedical research community. We will explore how the new annotation strategies can be involved in the software development process and help the domain experts in improving their decision-making process by enhancing the interpretation of the whole-slide images.
7. Research Summary	Advances in whole-slide imaging technology have transformed the field of pathology over the last 20 years. While early microscope scanners provided over 24 hours of scanning a single slide, the recent microscope scanners can digitize an entire glass slide within a few minutes, generating reliable and highly quantitative microscopy image data. As a result, digital pathology datasets have become increasingly common in clinical and basic science investigations. Artificial intelligence (AI) techniques including machine learning (ML) algorithms have been employed in detecting, diagnosis, treatment, and prevention of human cancers, aiming to promote the transition of modern pathology. Specialized software tools with on-board ML provide faster turnaround times in the quantitative analysis of whole-slide images (WSIs). However, extracting large-scale histological structures from the WSIs presents significant challenges for investigators to overcome. This research proposal will develop new ML methodology and a web-based open-source software to address: 1. the histologic feature identification and extraction of tissue fragment at various magnifications in the whole-slide images, improving the ML accuracy of cancer tissues; 2. an web-based open-source software, enabling the domain experts to find the histologic features with the small annotation effort so that the histologic findings can be determined very quickly. We will explore combinations of auto-encoder (AE) with contemporary unsupervised machine learning methods to determine the most important features among hundreds-of-millions of histologic objects, and how these features can be applied to the web-based open source software, improving the effectiveness of the cancer detection as well as reducing the burden of annotating the massive biomedical image data. Prototype of the web-based AI tools for whole-slide imaging analysis can be found from the link https://sites.google.com/view/sanghoon-lee/research.
8. Need for funding from Korean government	The living expenses should be paid by the Korean government. Two Korean students will perform the research work for one year and the researcher can teach the students for one year and $50,000 are expected to be paid for the researcher.
9. Request for Korean Universities	Please see the link above for the research interests and contact via email if you have any question.