

# 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

Salama Ikki

Date(mm-dd-yyyy)

27/01/2020

Signature of  
Chief of Research

Salama Ikki

*Salama Ikki*

*(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)*

<b>1. Research Title</b>	<b>ML For Wireless Physical Layer Communications Algorithm Design</b>						
<b>2. Research Area</b>	<b>A.I.</b>	<b>Big Data</b>	<b>Cloud Computing</b>	<b>Block Chain</b>	<b>AR/VR</b>	<b>ICT/SW Convergence</b>	<b>Other ICT /SW</b>
	<b>X</b>						
<b>3. Chief of research</b>	Title		Associate Professor		Contact	E-mail : <a href="mailto:sikki@lakeheadu.ca">sikki@lakeheadu.ca</a>	
	Name		Salama Ikki			Tel : +1-807-343-8183	
<b>4. Affiliation</b>	Name		Lakehead University		Classification	(X) University ( ) Research Institute ( ) Industry ( ) ETC.	
<b>5. Capacity for students (5 or less)</b>	One PhD student and one Post-Doctorate.			<b>Support for students (all necessary)</b>	( X ) Visa support ( X ) Research Mentoring ( X ) Research Space ( X ) Accessibility to Research equipment		
<b>6. Research Objective</b>	<p>Machine Learning techniques have undoubtedly demonstrated their usefulness and importance in recent years in the areas of image processing and natural language understanding. Studies have discovered that many traditional detection/estimation problems or decoding problems in communication networks and systems can exploit the mathematical model of specific Machine Learning techniques. The marriage of Machine learning and wireless communications yields new techniques that can lead to improvement in communication algorithm design (in terms of reliability, generality, latency and energy/spectral efficiency). This research initiative aims to understand the feasibility of merging Machine Learning technologies with traditional wireless communication theory and signal processing algorithms to address modern challenges in cellular and wireless communication systems.</p> <p><b>MIMO Equalization and Detection</b></p> <p>The goal is to use Machine Learning techniques to replace or at least modify high complexity MIMO equalization/detection algorithms such as Interference Rejection Combining in Massive MIMO scenario, or to</p>						

	<p>replace Maximum Likelihood Detection (MLD) algorithms for high dimensional modulation 64QAM, 256QAM, or 1024 QAM in 5G NR MIMO scenario.</p> <p><b>Joint Channel Estimation and MIMO Equalization</b></p> <p>Another aim is to investigate the Machine Learning model that integrates channel estimation together with MIMO equalization so that a systematic optimization can provide higher performance gain from joint optimization.</p>
<b>7. Research Summary</b>	<ul style="list-style-type: none"> <li>• Reports containing the algorithm survey, feasibility study, and a list of candidate algorithms and their analysis;</li> <li>• Reports on algorithm design, performance bound analysis, computation complexity analysis, and performance evaluation;</li> <li>• A complete simulation software including source codes and related description;</li> <li>• 1 or 2 IEEE Journals and 2 to 3 IEEE Conference Papers coordinates.;</li> </ul>
<b>8. Need for funding from Korean government</b>	<p><b>1) Students:</b> In this research proposal we seek support to appoint one PhD students with considerable experience in wireless communication theory, signal processing, detection and estimation theory, and mathematics. In addition, two undergraduate students with a solid background in communications and in mathematics is to be identified.</p> <p><b>2) Operation and maintenance costs:</b> Estimated costs for repairing and maintaining computer equipment (Hardware, monitors, printers, Toner, etc.), textbooks, photocopying and other consumable costs.</p> <p><b>3) Travel and Dissemination Costs:</b> To enable the applicant or the student to attend one important international conference in the field such as IEEE ICC, IEEE Globecom and IEEE VTC. The conference visits are necessary to ensure the results receive timely exposure in a competitive research field. These expenses will cover the registration fees and travel expenses (flight, hotel, ..., etc). Publication costs: Excess page cost/paper reprints for journal publication, photocopying, printing and mailing charges: \$500 per year. This allocation will be used to cover overlength publication fees that are charged by most top-tier journals. For example, IEEE Transactions on Communications currently has a mandatory over-length (&gt; 8 pages) page charge of US\$220 USD, hence a 10-page manuscript would cost approximately \$600 CAD to publish. This budget will also cover the cost of printing posters.</p>
<b>9. Request for Korean Universities</b>	<p>The research tasks can be divided between the two teams in my group and the selected Korean university; some of these tasks include:</p> <p>Review latest machine models used in academy and industries and analyze popular machine learning theories and models suitable for nonlinear system identification.</p> <p>Choose appropriate machine leaning models with different layers and parameters, and compare the performance based on given data.</p> <p>Model theoretical study and a development of new stable algorithms for calculation model parameters. Numerical simulations and preliminary programming. Providing preliminary complexity estimates on getting approximate values of parameters of complex DPD models.</p> <p>Algorithms optimization in a way which is the most suitable for implementation. Algorithms optimization for minimum number of layers and common operations for DPD models examined under different data.</p>