



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

KRISHNA DEV KUMAR

Date(mm-dd-yyyy)

01-30-2020

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 Artificial Intelligence based Fault Detection, Isolation, Prognosis, and Control System						
2. Research Area	A.I.	Big Data	Cloud Computing	Block Chain	AR/VR	ICT/SW Convergence	Other ICT /SW
	X	X	X			X	
3. Chief of research	Title	Professor		Contact	E-mail : kdkumar@ryerson.ca		
	Name	Krishna D. Kumar			Tel : +1-416-979-5000 Ext. 4908		
4. Affiliation	Name	Ryerson University		Classification	(X) University () Research Institute () Industry () ETC.		
5. Capacity for students (5 or less)	5		Support for students (all necessary)		(X) Visa support (X) Research Mentoring (X) Research Space (X) Accessibility to Research equipment		



<p>6. Research Objective</p>	<p>The main objective of the research is to develop artificial intelligence based fault detection, isolation, prognosis and control systems. It will involve the following five sub-objectives:</p> <p>Objective 1: to study fault detection and isolation (FDI) of a complex system using artificial intelligence techniques. (Student 1)</p> <p>Objective 2: to study fault detection and isolation of a swarm of heterogeneous multi-agent systems using hybrid - artificial intelligence and model-based - techniques. (Student 2)</p> <p>Objective 3: to study failure prognosis and the remaining useful life (RUL) of a complex system using artificial intelligence techniques. (Student 3)</p> <p>Objective 4: to study failure prognosis and remaining useful life (RUL) of a swarm of heterogeneous multi-agent systems using hybrid - artificial intelligence and model-based - techniques. (Student 4)</p> <p>Objective 5: to study fault tolerant control (FTC) of monolithic and heterogeneous multi-agent systems using artificial intelligence and hybrid - artificial intelligence and model-based - techniques. Here FTC involves fault detection and isolation (FDI), robust control, and reconfigurable control (RC). (Student 5)</p>
<p>7. Research Summary</p>	<p>The proposed research will focus on developing artificial intelligence based fault detection, isolation, prognosis, and control systems. The research will be conducted under five main areas: 1) Fault detection and isolation (FDI) of a complex system, 2) Fault detection and isolation of a swarm of heterogeneous multi-agent systems, 3) Failure prognosis and remaining useful life of a complex system, 4) Failure prognosis and remaining useful life of a swarm of heterogeneous multi-agent systems, 5) Fault tolerant control of monolithic and heterogeneous multi-agent systems. Here, the systems represent large complex systems, each comprising of several subsystems with more than millions of parts, such as aircraft, spacecraft, CNC machines, a network of computers etc. The failure of a single part or series of parts can lead to catastrophic failure of a system or a swarm of systems. Dr. Kumar's previous research on FDI, prognosis, fault tolerant control for aircraft, spacecraft, formation flying of spacecraft, and multi-agent systems using artificial intelligence techniques (include Recurrent Neural Networks, Long Short-Term Memory (LSTM) based Recurrent Neural Networks, Growing Neural Networks, Fuzzy Logic, Genetic Algorithms, and Particle Swarm Optimization) and model-based techniques (include adaptive unscented Kalman filter, sliding mode observer, and particle filter) will be considered and the novel algorithms based on artificial intelligence techniques as well as hybrid - artificial intelligence and model-based - techniques will be developed. These algorithms will be tested via cloud-computing as well on the Big Data analytics platform, SSBQuery available in Dr. Kumar's Artificial Intelligence for Aerospace Systems (AIAS) Laboratory. Finally, the proposed research will lead to the development of high performance autonomous and intelligent systems as well as training of five graduate students in the most demanding areas of artificial intelligence, big data, cloud computing, and ICT/SW convergence.</p>
<p>8. Need for funding from Korean government</p>	<p>The proposed research will involve 5 students to study various aspects of the problem. The funding needed for each student is \$23,000. The total funding needed for 5 students is \$115,000.</p>



**9. Request
for Korean
Universities**

The selection of students studying in South Korea should be conducted after mutual consultation. The Ryerson International office will assist the students to prepare for VISA.