Position Profile for Chinese Applicants running for 2019 Helmholtz – OCPC – Program

PART A (Info about the Position)
Helmholtz Centre and institute: DESY; FLASH-D, MSK, MFL, MCS4

Title of the project: Deep Reinforcement Learning for Intelligent Particle Accelerator Control

Project leader: Dr. Kai Tiedtke, Dr. Christopher Behrens, Dr. Christopher Gerth, Dr. Siegfried Schreiber, and Dr. Tim Wilksen

Web-address: http:// flash.desy.de

Description of the project:
DESY is one of the world's leading research center for photon science and accelerator physics. Both research fields are strongly connected and progress in intelligent, autonomous particle accelerator control methods would result in exceptional mutual benefit.
Accelerators utilized in photon science, e.g., as drivers for free-electron lasers, are nowadays operated by means of classical methods from control theory. While this approach provides a strong and robust foundation for accelerator control with fairly good performance, many control tasks and optimizations still have to be performed by human operators. However, in order to ensure consistent and close to optimal operation, software agents with human-level skills in accelerator control are highly desired.
One very promising candidate to achieve human-level control or even beyond is Deep Reinforcement Learning. Reinforcement learning (RL) is an area of machine learning concerned with how software agents ought to take actions in an environment so as to maximize some notation of cumulative reward. Deep reinforcement learning extends RL by using a deep neural network and without explicitly designing the state space.
In this project, we ultimately envision the development of RL-based software agents, overcoming limitations in nowadays particle accelerator control. The applicant of this position is expected to establish the basis for reinforcement learning within the field of accelerator control, e.g., defining environments for the learning agents. A plethora of data recorded continuously and stored for off-line analysis can be exploited to get insight in relevant parameters for building a model of the accelerator, serving as a virtual environment for learning. The applicant is expected to implement, train, and validate various RL software agents within these environments and to eventually test them in the actual accelerator environment. Thorough documentation and clear communication of the results and findings are mandatory.

Required qualification of the post-doc:

- PhD in computer science, engineering or a related field
- Experience with machine learning, deep learning, reinforcement learning
- Additional skills in software engineering, python ecosystem, data mining

PART B (Materials and Procedures)

The applicants shall submit the following documents to a Chinese postdoc station affiliated to a research institution or a university, after passing through the internal selection, the qualified application shall be forwarded to OCPC, and then to Helmholtz for evaluation:

- Detailed description of the interest in joining the project (motivation letter)
- Curriculum vitae, copies of degrees
- List of publications
- 2 letters of recommendation
- Proof of command of English language

PART C (General Conditions)

Additional requirements on the postdoctoral fellows:

- Chinese citizenship from Mainland China (allows application while staying abroad)
- Max. age of 35 years, PhD degree not more than 5 years by submission of application
- Very good command of English language
- Strong ability to work independently and in a team