

Training Opportunity for Portuguese Trainees

Reference	Title	Duty Station
PT-2019-TEC-SWT	Artificial Intelligence for embedded space systems	ESTEC

Overview of the Unit missions:

The [Software Systems division](#) has the responsibility in domain of software engineering for flight and ground software systems. It is supporting all ESA satellite projects in the related technologies, covering Software engineering technologies, methods, tools, architectures, and standards. Specific interest goes into the aspect of System-software co-engineering over the entire development life-cycle, starting from requirements engineering and modelling, design methods, to automatic code and test generation, including the required languages and compilers. Modelling and Simulation is used to support system engineering and testing and verification.

Advanced SW technologies as Artificial Intelligence, Big Data and Data Warehousing are investigated for their potential to improve future systems capabilities and their way to develop them.

This opportunity is offered in the [Software Technology Section](#).

Overview of the field of activity proposed:

Artificial intelligence is more and more used in Ground space applications. One main domain of application concerns Machine Learning. In this domain, applications able to identify elements of interest on space images are already developed and new ones are being developed. These applications are mainly based on Deep Learning architectures mostly implemented by artificial neural networks.

The training of such neural networks requires intensive processing that is largely exceeding the capabilities of embedded space systems. However, their execution is less demanding in term of processing and could now fit the most recent or coming architectures.

Among these architectures, multi-core processors ([GR740](#)), FPGAS ([BRAVE medium](#)) and SoCs ([BRAVE Large/Ultra](#), [DAHLIA](#), [HPDP](#) and ZynQ) grouping processor(s) and reconfigurable FPGA.

If Deep Neural Networks are usually considering the use of GPUs to minimize the execution time, they can be executed on generic purpose processors (full Software) with less performance. Thanks to the availability of systems including a processor and a FPGA, a HW/SW co-design approach enables a split between functions executed on the processor(s) and the ones executed on the FPGA.

During the proposed activity, the candidate shall:

- Evaluate the existing Deep Neural Network systems, identify their needs in term of processing and select one of them.
- Evaluate the new embedded computer architectures, with a special focus on SoCs and select one of them.
- Follow a HW/SW co-design approach to identify the functions to be executed on the processors and the functions to be executed on the FPGA.
- Apply the approach and port the selected Deep Neural Network on the selected embedded system.
- Measure the performance of the Deep Neural Network.
- Potentially iterate to optimize the allocation of functions.

Required Education:

Applicants should have just completed, or be in their final year of a University course at Masters Level (or equivalent) in a technical or scientific discipline.

Applicants should have good interpersonal and communication skills and should be able to work in a multi-cultural environment, both independently and as part of a team.

Applicants must be fluent in English and/or French, the working languages of the Agency.