HYPERCOMP: Hyperspectral Computing Laboratory – University of Extremadura

RED2018-102384-T

M. E. Paoletti, J. M. Haut, A. Plaza and **J. Plaza**
Contact: jplaza@unex.es

Mission

Efficient processing of remotely sensed hyperspectral images using HPC architectures using both, homogeneous/heterogeneous networks of computers and specialized architectures such as GPUs and FPGAs.

Vision

Develop new hyperspectral data processing techniques with special attention to efficient implementations *which take advantage of high performance computing resources, including the possibility of providing real-time processing solutions.*

Group Profile

Research

- **Advanced hyperspectral data processing techniques:**
  - Classification
  - Nonlinear unmixing
  - Target detection
  - Deep learning-based solutions
- **Efficient processing techniques**
  - GPU/FPGA implementations
  - Homogeneous/heterogeneous computing
  - HPC/Cloud optimization problems

Recent / Ongoing Results

- **EOXPOSURE (H2020-MSCA-RISE-Grant 734541):** Tools for mapping human exposure to risky environmental conditions by means of ground and earth observation data
- **DL4HErO (¿H2020-Widespread-Twinning?):** Deep Learning for Hyperspectral EaRth Observation
- **APRISA (¿Plan Nacional-2019?):** Development of Deep learning techniques for optimization of supercomputing infraestructura and hyperspectral imaging applications.
- **Red-RISCV (RED2018-102384-T):** Investigación, Formación e Innovación en Sistemas RISC-V.

Training/Teaching

- **Computer Technology (B.S)**
- **Computer Structure (B.S)**
- **Computer Organization and Architecture (B.S).**
- **Graphic Processing (B.S)**
- **Distributed Computing (B.S)**
- **High Performance Computing (M.S)**

- **"High Performance and Cloud Computing for Remote Sensing"** International Tutorial, Valencia, 2018.
- **Mixed teaching courses: on-line (MOOC) & Classroom**
- **Publications:**
  - High Performance Computing in Remote Sensing. Chapman & Hall/CRC Press, Taylor & Francis, 2007.
- **UEX** Engineering School: **Hardware** subjects **updated & harmonized** on **RISC-V basis** (initial phase)

Innovation

- **New specialized processors for on-board hyperspectral image processing**
- **FPGAs and GPUs with low power-consumption for onboard processing**
- **New on-board implementations of machine learning algorithms for hyperspectral data interpretation.**

- **Different kinds of architectures tested for remote sensing data procesing:**
  - **NVidia Jetson Tegra TX2**
  - **NVidia GeForce 1080**
  - **NVidia Tesla P100 GPU**
  - **Multicore heterogeneous Xeon**
  - **Other kinds of FPGAs and heterogeneous CPU-GPU processors**

Group positioning & Perspectives in front of Open-Hw & RISC-V

R+D+i+T

- **Open Hw/Sw allows for advanced implementations of remotely sensed hyperspectral imaging algorithms.**
- **Training & education of new generations of remote sensing hyperspectral imaging scientists using Open Hw/Sw.**
- **Low power RISC-V cores for remotely sensed hyperspectral data interpretation.**
- **Open collaborations with many european and chinese partners on the exploitation of RISC-V architectures in Earth observation.**
- **Testing and validation of hardware in special conditions (e.g. from space, radiation tolerance, power consumption).**

Global Remarks

"To achieve efficient processing of remotely sensed hyperspectral images using HPC architectures using both, homogeneous/heterogeneous networks of computers and specialized architectures such as GPUs and FPGAs"

"To develop new hyperspectral data processing techniques with special attention to efficient implementations which take advantage of high performance computing resources, including the possibility of providing real-time processing solutions."