Uni.lu HPC School 2019
PS10b: Python II (Advanced) Parallel Machine learning and Evolutionary Computation

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http://hpc.uni.lu
Latest versions available on Github:

UL HPC tutorials:  
https://github.com/ULHPC/tutorials

UL HPC School:  
http://hpc.uni.lu/hpc-school/

PS10b tutorial sources:  
ulhpc-tutorials.rtfd.io/en/latest/python/advanced/
Introduction

Summary

1 Introduction

2 Parallel machine learning with ipyparallel

3 Parallel evolutionary computing with scoop
Main Objectives

1. How to parallelise your python code?
2. Hereafter, we are going to see two alternatives:
   → High-level approach with ipyparallel for scikit-learn
   → Low-level approach with scoop
Summary

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3. Parallel evolutionary computing with scoop
Scikit-learn + ipyparallel

- **Scikit-learn**athers numerous:
  - Machine learning algorithms (e.g. SVM)
  - Data analysis approaches (e.g. PCA)
  - Data mining techniques (e.g. Clustering)

- Scikit-learn algorithms can be parallelised
- Especially useful for Hyper-parameters search
- Scikit-learn relies on **ipyparallel** and **joblib** libraries to parallelism algorithms
Parallel machine learning with ipyparallel

Ipyparallel

- Originally designed under **IPython**
- IPython’s architecture for parallel and distributed computing
- Support many different styles of parallelism:
  - Single program, multiple data (SPMD) parallelism
  - Multiple program, multiple data (MPMD) parallelism
  - Message passing using MPI
  - Task farming
  - Hybrid approaches combined the above ones
- Ipyparallel can detect a job scheduler (e.g. Slurm) when started on a HPC platform
Please go to https://ulhpc-tutorials.readthedocs.io/en/latest/python/advanced/scikit-learn/
Parallel evolutionary computing with scoop

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Scoop + deap

- Deap
  - Python evolutionary computing library:
    - Genetic algorithms
    - Particle swarm algorithms
    - Evolutionary strategies
    - Estimation of Distribution algorithms
  - Deap relies on **scoop**
Parallel evolutionary computing with scoop

Scoop

- **SCOOP** => Scalable COncurrent Operations in Python
- Applications of SCOOP:
  - Evolutionary algorithms
  - Monte Carlo simulations
  - Data mining
  - Data processing
  - Graph traversals
- Very simple to use
- Override default map (reduce) function
Parallel evolutionary computing with scoop

Practical session

Please go to https://ulhpc-tutorials.readthedocs.io/en/latest/python/advanced/scoop-deap/
Questions?

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