Particle Swarm Optimization: OpenMPI approach

Bortolotti Samuele, Izzo Federico

2022-11-22

Contents

1 Particle Swarm Optimization OpenMPI

ParticleSwarmOptimization-openMPI provides an basic implementation of PSO with support for cluster computation through OpenMPI, moreover it uses OpenMP for thread parallelization.

PDF report can be found here

1.1 How to use

1.1.1 Build

1.1.1.1 Binary

```
make
```

1.1.1.2 Docker

```
make docker-build
```

with optional argument `DOCKER_TAG`

```
make DOCKER_TAG=mytag docker-build
```

1.1.1.3 Udocker

```
make cluster-pull
```

1.1.2 Run

1.1.2.1 Local

```
./bin/particle-swarm-optimization pso-data.ini
```

for optional arguments plese execute `./bin/particle-swarm-optimization --help`.

1.1.2.2 Cluster (through PBS)

Number of runs should be specified directly inside this script

```
make cluster-run
```

1.1.3 Report

```
make report
```

1.2 OpenMPI

OpenMPI library is used to convey information across processes running on different nodes of a cluster. The basic information unit is composed as a broadcast message shared over the whole network, in this way all particles of Particle Swarm Optimization (PSO) are able to know all information associated to other members of the swarm.

The process that produces the message sends the message using a gather function because all particles must know the positions of other individuals of the population at every step. In the following picture it is presented a simple schema of the communication.

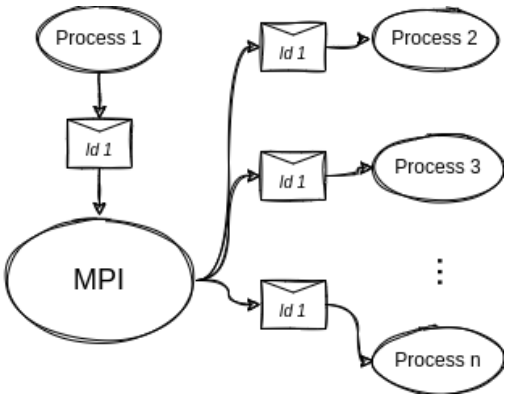

Figure 1: Communication schema

1.3 Process

A process can have the task of computing the algorithm for one or more particles, it is divided in several threads that optimize the execution time of the process.

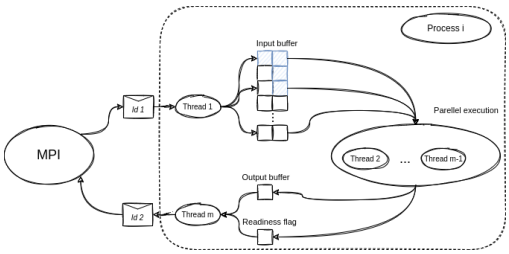

Figure 2: Execution schema