

Jack Hanlon

V00843015

RUNNING THE EMC ALGORITHM

Firstly, it is important to note that the input data is pulled from the scattering.csv and so this file must be in the same project folder as the python file you are trying to run.

The batch file “launch-python-cuda-environment.bat” needs to be ran to setup the base for the following python files.

There are three files, that do EMC in their own way:

emc_cpu.py:

Runs a single photon for a specified number of scatterings.

Input:

Takes as input two arguments. The first is an integer number that represents the number of scatterings, and the second is a 0 or 1 bit that allows user to pretty print the first 5 scatterings the photon experiences.

Output:

Use case 1 (Only specifying number of scatterings):

```
(base) C:\Users\jack1\Documents\CSC_497\GPU-Mars-SAR\src>python emc_cpu.py 1000  
total time to compute 1 photon for 1000 scatterings on CPU: 1.289641(s)
```

Use case 2 (Number of scatterings and pretty print on):

```
(base) C:\Users\jack1\Documents\CSC_497\GPU-Mars-SAR\src>python emc_cpu.py 1000 1
First 5 scatterings of a photon and updates to m,n,s and E
Scattering 0
E:
[1.+0.j 0.+0.j]
m:
[1 0 0]
n:
[0 1 0]
s:
[0 0 1]
Scattering 1
E:
[-0.52072446-0.54529415j  0.0666183 +0.65350006j]
m:
[-0.19134172+0.j  0.46193977+0.j -0.8660254 +0.j]
n:
[-0.92387953+0.j -0.38268343+0.j  0.      +0.j]
s:
[-0.33141357+0.j  0.80010315+0.j  0.5      +0.j]
Scattering 2
E:
[ 0.87549519-0.3069801j  -0.06414453+0.36763687j]
m:
[-0.55029969+0.j -0.67777436+0.j  0.48763939+0.j]
n:
[ 0.73401212+0.j -0.11431247+0.j  0.66944669+0.j]
s:
[-0.39799054+0.j  0.72632953+0.j  0.56040071+0.j]
Scattering 3
E:
[ 0.07428011+0.65434222j -0.18681946-0.72898369j]
m:
[ 0.65461217+0.j -0.32701275+0.j  0.68157579+0.j]
n:
[ 0.68292449+0.j  0.64244986+0.j -0.34766697+0.j]
s:
[-0.32418674+0.j  0.69305183+0.j  0.64388052+0.j]
Scattering 4
E:
[0.74374338-0.06584371j  0.66116845-0.07325751j]
m:
[ 0.61820519+0.j -0.46624132+0.j  0.63280438+0.j]
n:
[ 0.74379924+0.j  0.60730343+0.j -0.27918675+0.j]
s:
[-0.25413587+0.j  0.64327411+0.j  0.72222807+0.j]
total time to compute 1 photon for 1000 scatterings on CPU: 1.290619(s)
```

Catches errors for wrong input type or wrong number of arguments.

emc_cpu_multi.py:

Runs M photons for N processes in parallel using multiprocessing on CPU.

Input:

Takes as input two arguments. The first is an integer specifying the number of scatterings and the second being the number of photons to run. Both need to be positive integers otherwise an error will be thrown. No pretty print option.

Output:

Arbitrary Use Case (Inputting 1000 scatterings/photon and 15 photons):

```
(base) C:\Users\jack1\Documents\CSC_497\GPU-Mars-SAR\src>python emc_cpu_multi.py 1000 15
total time to compute scatterings for this photon on CPU: 3.530034 (s)
total time to compute scatterings for this photon on CPU: 3.557811 (s)
total time to compute scatterings for this photon on CPU: 3.633201 (s)
total time to compute scatterings for this photon on CPU: 3.648082 (s)
total time to compute scatterings for this photon on CPU: 3.618817 (s)
total time to compute scatterings for this photon on CPU: 3.628737 (s)
total time to compute scatterings for this photon on CPU: 3.693716 (s)
total time to compute scatterings for this photon on CPU: 3.631707 (s)
total time to compute scatterings for this photon on CPU: 3.238883 (s)
total time to compute scatterings for this photon on CPU: 3.080161 (s)
total time to compute scatterings for this photon on CPU: 3.305344 (s)
total time to compute scatterings for this photon on CPU: 3.087104 (s)
total time to compute scatterings for this photon on CPU: 3.248303 (s)
total time to compute scatterings for this photon on CPU: 3.144144 (s)
total time to compute scatterings for this photon on CPU: 3.228959 (s)
total time to compute scatterings for all photons on CPU: 8.776901 (s)
```

emc_gpu.py:

See Requirements Specification Document