Project Presentation

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```
41  void* tickHelp(void *arg){
42    struct interval myInterval = *((struct interval*)arg);
43    for (int i=myInterval.left; i<myInterval.right; i++){
44      (*myInterval.agents)[i]->whereToGo();
45      (*myInterval.agents)[i]->go();
46    }
47  }
48
49  void Ped::Model::tick(){
50    int numAgents = agents.size();
51    int numProc = np;
52
53    if (getPar() == PTHREAD){
54      int blocksize = agents.size()/numProc;
55      pthread_t threads[numProc];
56      struct interval * intervals[numProc];
57
58      for (int i=0;i<numProc;i++){
59        intervals[i] = new struct interval();
60        intervals[i]->left = i*blocksize;
61        intervals[i]->right = (i+1)*blocksize;
62        intervals[i]->agents = &agents;
63        pthread_create(&threads[i], NULL, &tickHelp,(void*) intervals[i]);
64      }
65      void * result;
66      for (int i=0; i< numProc;i++)
67        pthread_join(threads[i], &result);
68    } else if (getPar() == OMP) {
69  #pragma omp parallel for num_threads(np)
70      for(int i=0;i<numAgents;i++){
71        agents[i]->whereToGo();
72        agents[i]->go();
73      }
74    } else {
75      for(int i=0;i<numAgents;i++){
76        agents[i]->whereToGo();
77        agents[i]->go();
78      }
79    }
80  }
81
```

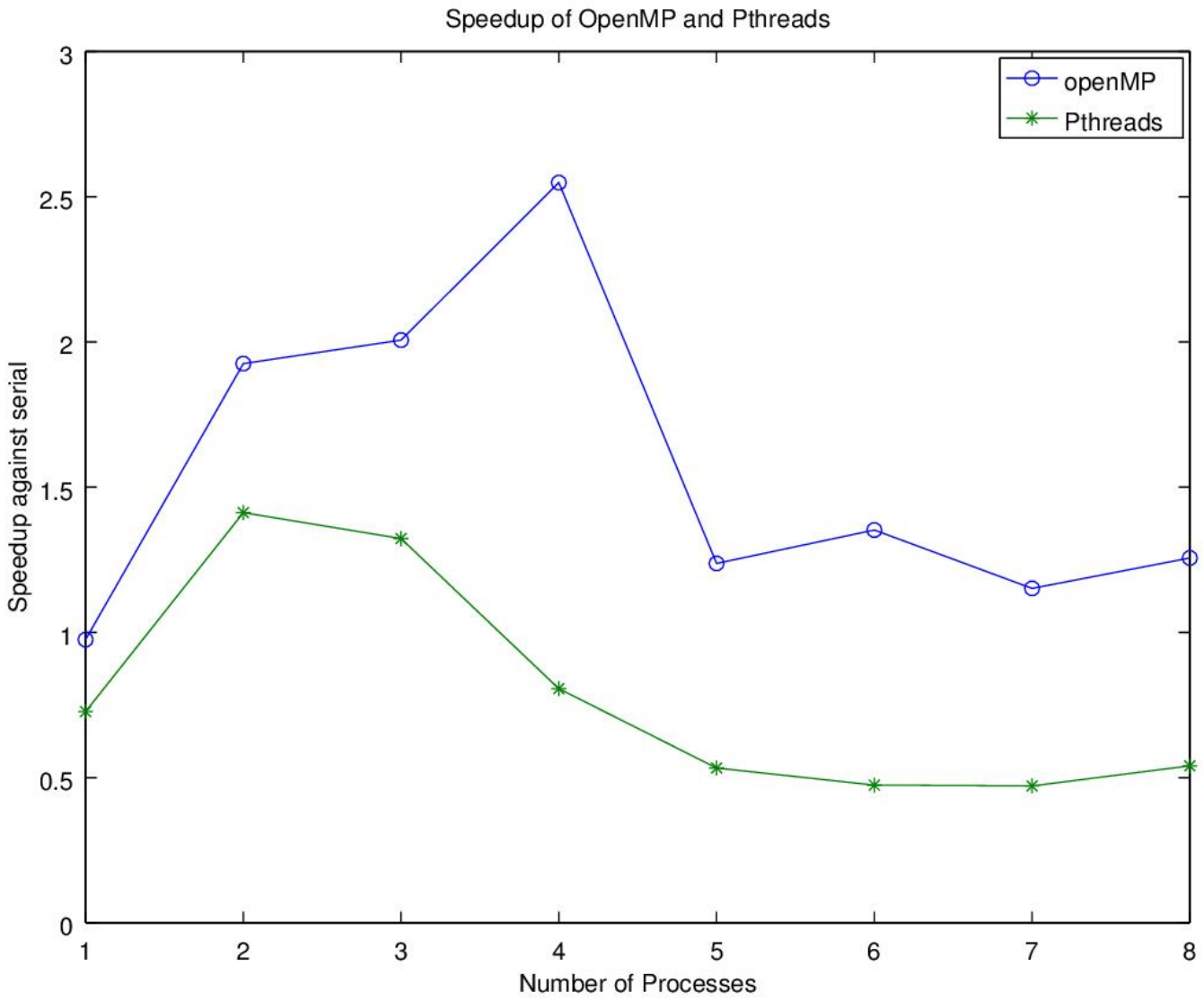

Figure : Graph showing the speedup of openMP and pthreads for 1 to 8 threads.

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Assignment 2

- New data structure: e.g. x[NumOfAgents] instead of agent[i].x
- New versions of whereToGo() and go(), for vectorization and CUDA

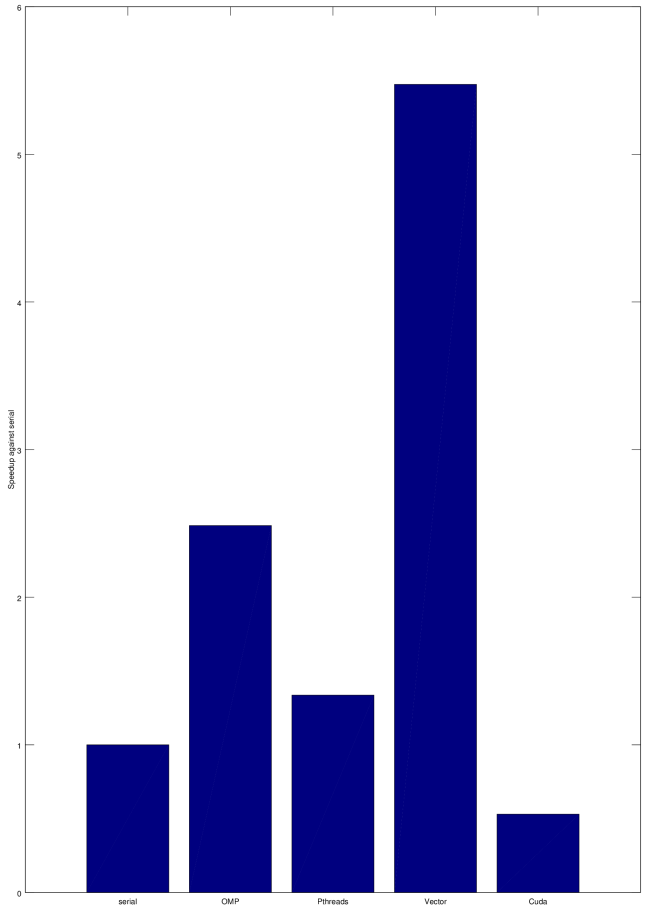

Figure : Speedup 2048 agents

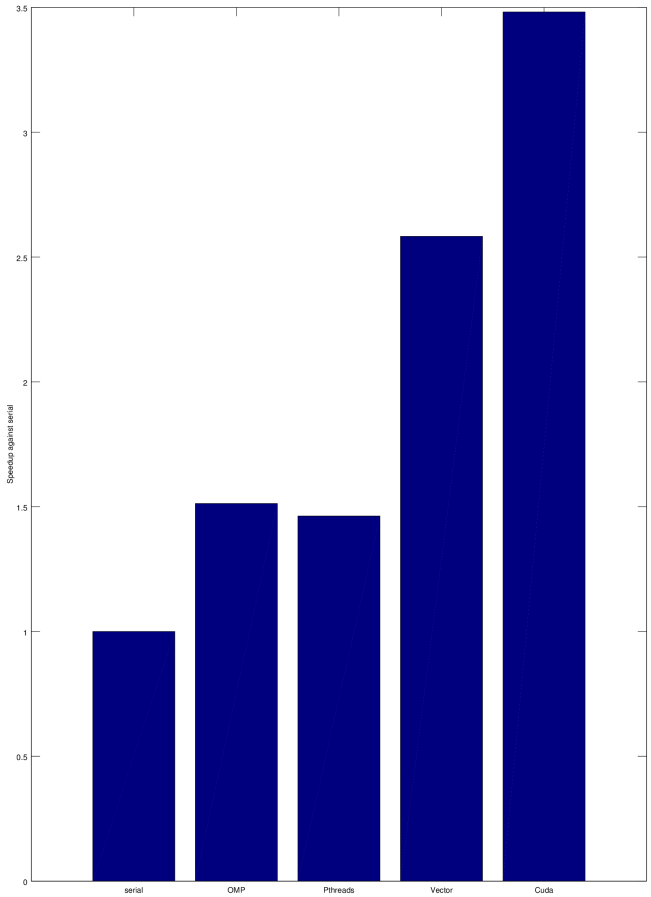

Figure : Speedup 480000 agents

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Assignment 3

- Exchanged the tree structure to a simple 2d grid
- Two solutions: region-based pthreads implementation and simple omp pragma

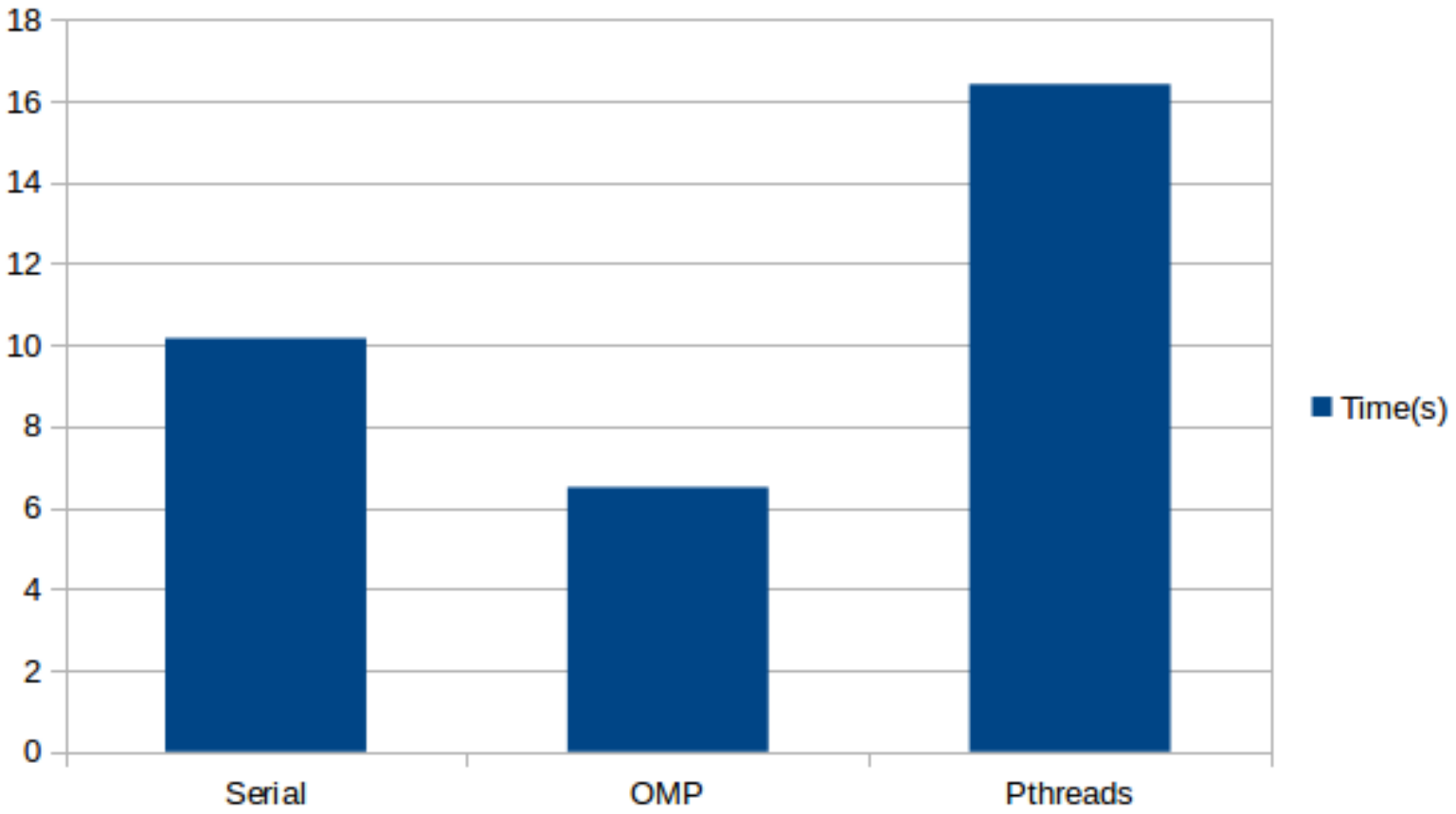

Figure : Runtime 2048 agents (before duplicates)

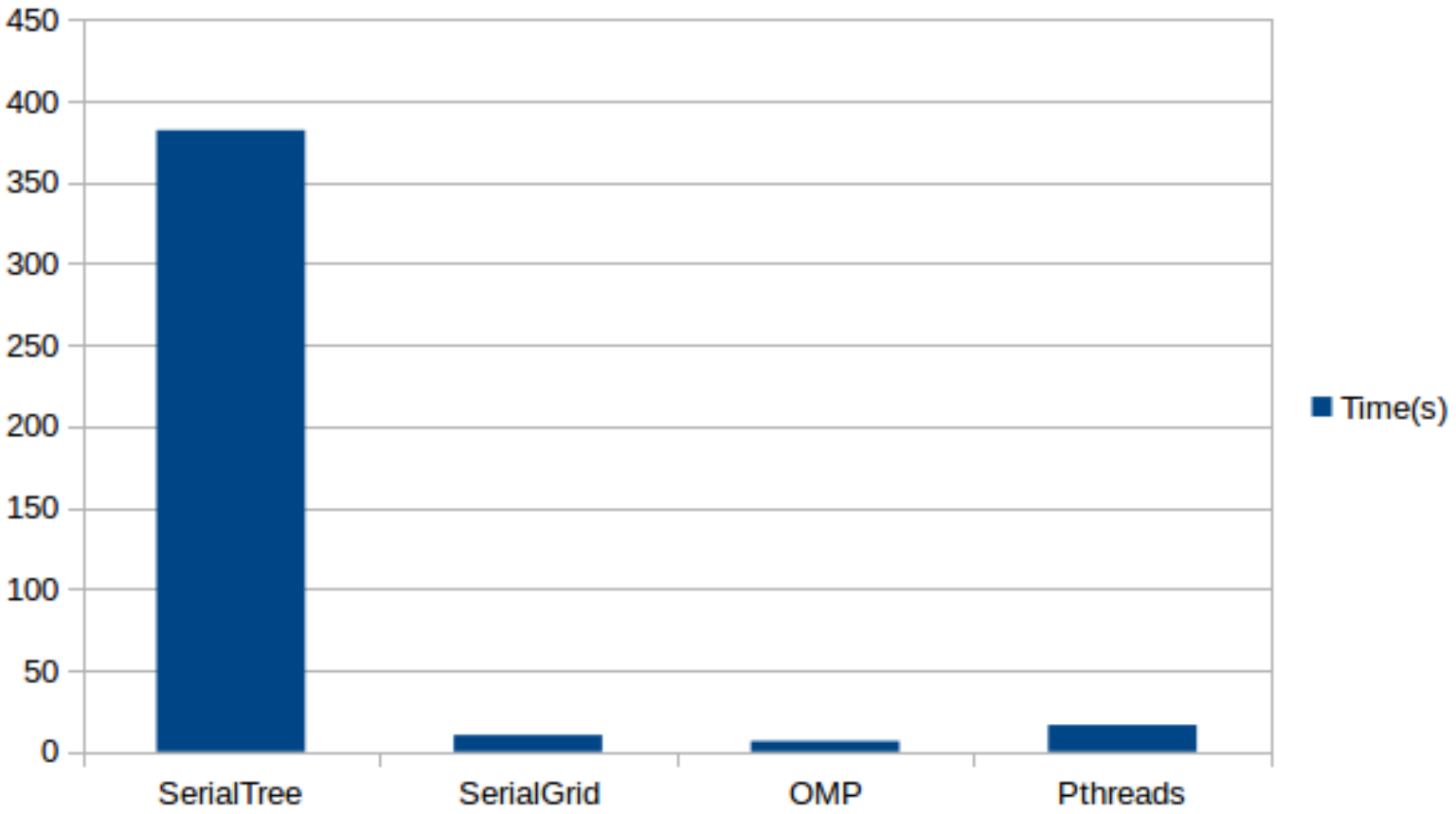

Figure : Runtime 2048 agents (before duplicates)

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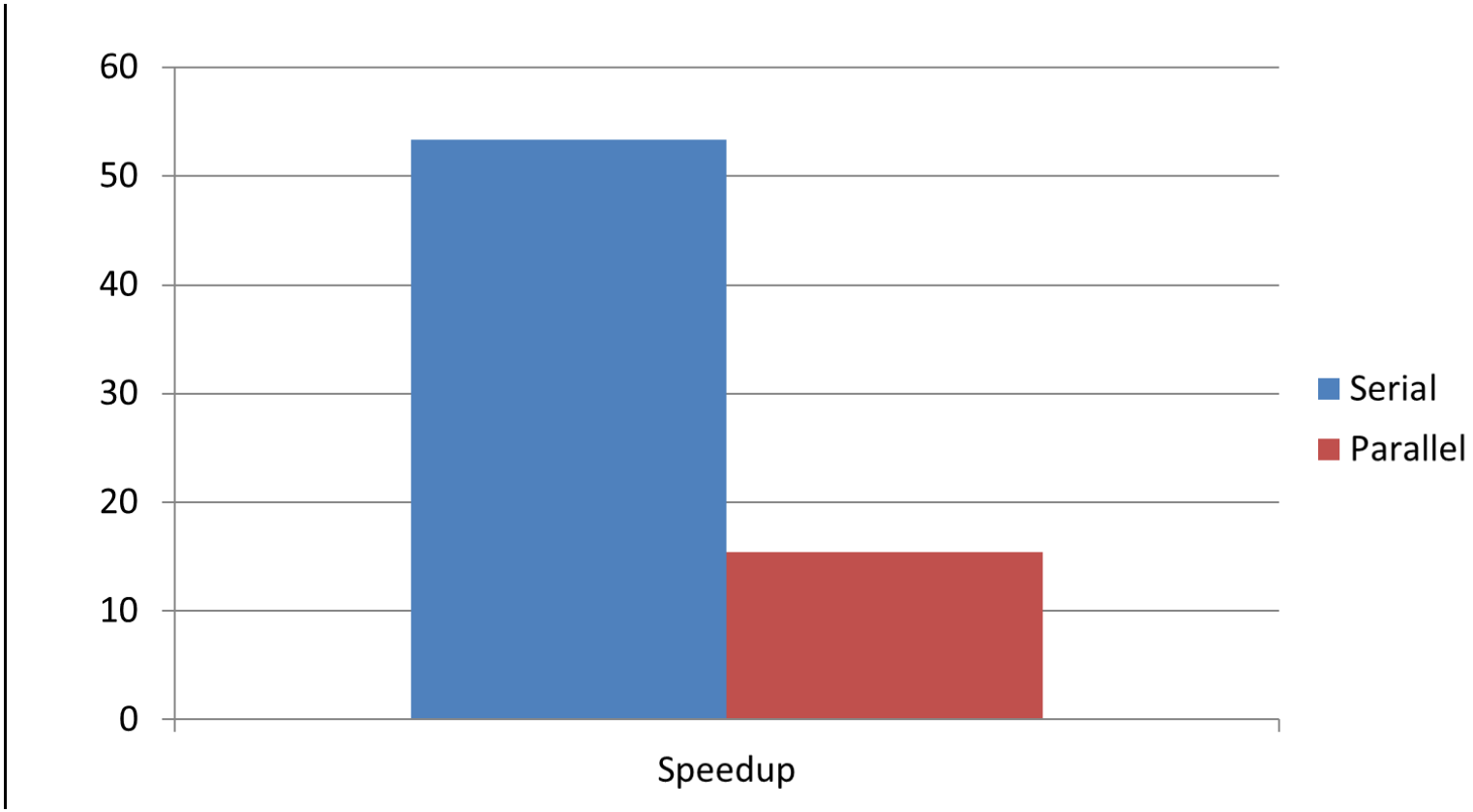
Assignment 4

Four CUDA kernels:

- Fading the heatmap
- Updating the heatmap with agent information
- Scaling the heatmap
- Adding a gaussian blur filter to the heatmap

CPU	GPU
WhereToGo	Fade
Synchronize with GPU	
Collision detection	Update
	Scale
	Blur
Synchronize with GPU	


60
50
40
30
20
10
0
Speedup
Serial
Parallel

VERITAS
NATURAE
OBSERVATIONES ACADEMIAE IULIENSIS

Observations

- Cuda could lead to a performance degredation when dealing with small amounts of data, memory allocation overhead, synchronization, etc.
- Easier to implement and debug with SIMD
- Parallel execution in CPU and GPU with CUDA
- Right design can reduce synchronization between CPU and GPU