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3180, Oak Road
Walnut Creek, CA
USA, 94597
Phone: +1-9253848354
Email: rahulgayatri84@gmail.com

To Whomever It May Concern,

This is a cover letter for the position of *AMD Research: Systems Design Engineer*. My name is Dr. Rahulkumar Gayatri and I am currently working as a NESAP PostDoc at Lawrence Berkeley National Lab in the NERSC department. In here I am involved in the following two projects

1. **SW4** - Seismic Waves of 4th order accuracy.
   It is an Exascale Computing Project (ECP), where my role is to optimize the performance of the code on Intel's Knights Landing (KNL) processors. For this, I use techniques such as cache-blocking, vectorization and reducing the overhead incurred due to OpenMP directives. We are currently working on running large scale simulations of SW4 on the Cori supercomputer. For this the goal is to use all 9K KNL nodes available on Cori.

2. **Performance Portability** - I also work on implementing portable application codes using programming models such as OpenMP{3.0, 4.5}, Kokkos, Cuda, Raja. The aim is to determine the effort required and the performance achieved when using these programming models. I am currently working on porting Berkeley GW (BGW), a set of material science application kernels using the above mentioned programming models. https://github.com/rahulgayatri23/BGW-Kernels

I use profiling tools such as Intel's Vtune, Advisor, SDE and Nvidia's Visual Proflier(nvvp) and nvprof to analyze the application characteristics. These profiles give us an understanding of what limits the application performance. I use *roofline* plots to understand how an application performs compared to the peak performance for a given architecture.

Prior to my PostDoc, I worked as a technical specialist in the High Performance Computing group (HPC) at Wipro Infotech, Bangalore, India. As part of this group, I provided technical assistance to clients who wanted to parallelize their application/algorithm to achieve higher performance on their multi-core architecture. During this time, one of my major projects was "Moose" https://moose.ncbs.res.in/. It involved simulation of neural interactions in a human brain. This project is designed and implemented at the National Center for Biological Sciences, India (NCBS). The application uses a set of linear solvers to calculate the chemical and electrical interactions between the neurons. I used OpenMP to parallelize the solvers and achieved an average of 6X performance improvement on an 8-Core processor.

I graduated my Doctoral thesis from Barcelona Supercomputing Center (BSC), Barcelona, Spain in March, 2015. My advisors were Rosa M.Badia and Eduard Ayguade. During this period, I was art of the Programming Models group at the Barcelona Supercomputing Center (BSC). My Doctoral thesis was focused on speculative synchronization techniques for OMPSs, a task-based programming model.
I extended the framework to speculatively update shared memory locations using STM instead of the tradi-

tional lock and mutex based mechanisms. An extension to speculative memory updates is the speculative execution of tasks, where tasks can be scheduled before their presence in the execution flow can be confirmed. I implemented a lighweight rollback mechanism which can be used to undo the updates of tasks in case of speculation failure. The idea of greedy task execution improved the performance by an average of 20% for a select category of applications. At BSC, I also worked on porting applications from the domain of linear iterative solvers and graph algorithms using SMPSs, OMPSs implementation for SMPs. These applications are now a part of their application repository.

For my Master thesis, I designed and implemented a Breadth First Search algorithm, that optimises the use of low memory available in the Synergistic Processing Element(SPE) of IBM's Cell.B.E processor. The strong point of this implementation was the design of the data structure used to represent a node.

My current work with optimizing applications for a given architecture and my skills in the field of HPC and Parallel programming make me an ideal candidate for this position. The information regarding my publications is available in my resume. Please let me know if there are any other materials or information that will assist you in processing my application. Thank you for your consideration. I look forward to hearing from you.

Sincerely,

Rahulkumar Gayatri