ASC Student Supercomputer Challenge (2016)

Preliminary Contest Notifications

Dear Participating Teams:

Thank you very much for participating in the ASC Student Supercomputer Challenge 2016 (ASC16). This document will provide detailed information about the preliminary round of the contest.

1. About the Preliminary Round

In the preliminary round, each registered team is required to submit a set of documents that include a proposal, optimized source code files and output files (detailed requirements specified in Appendix A). The proposal needs to be written in English, and will be reviewed by the ASC evaluation committee.

2. Submission Guideline

All teams should make their submissions to info@asc-events.org before 9:00 AM, March 2nd, 2016 (UTC/GMT +8：00). The confirmation of your submission will be sent to you by email. The submission should include the following items:

a) The proposal file (in .doc or .pdf format), named with the university or college name and the contact person name (e.g. AAAUniversity_BBB.doc)**.**

b) The additional files should be compressed into one file (e.g. AAAUniversity_BBB.zip, other compression formats are also OK). The compressed file should at least include: (detailed requirements specified in Appendix A)

- Output files of HPCG
- Log files of MASNUM_WAM
- Optimized source codes and log file of DNN

3. For any further inquiries about the contest, please contact the ASC committee through the following emails:

a) Technical support: techSupport@asc-events.org

b) Contest organization: info@asc-events.org

c) News and media: media@asc-events.org

We wish you the best of luck at ASC16.

ASC16 Committee

01-06-2016

Appendix A: Proposal Requirements

I. A brief background description of the university's or the department's supercomputing activities (5 points)

1. Supercomputing-related hardware and software platforms
2. Supercomputing-related courses, trainings, and interest groups
3. Supercomputing-related research and applications
4. A detailed description of the key achievements on supercomputing research (no more than 2 items), attached with proof materials (published papers, award certificates, etc.)

II. Introduction of the Team (5 points)

1. Brief description of the building process of your team
2. Brief introduction of each team member (including group photos of the team)
3. Your team slogan.

III. Technical proposal requirements (90 points)

1. Design of your HPC system (15 points)

a) Within the 3,000-watt power budget, your system should be designed to achieve the best performance of HPCG and the MASNUM_WAM application.

b) Specify your system's software and hardware configuration and interconnection. Describe the power consumption, evaluate the performance, and analyze the advantages and disadvantages of your proposed architecture.

c) Your system should be based on the Inspur NF5280M4 server. The components will be listed before the final. Other components (except the server itself) are acceptable, but should be prepared by the teams at their own costs. For example, you can change the number of NF5280M4 servers and accelerators, the type of the hard disk and memory, and even the type of the Ethernet in your proposed configuration.

2. HPCG Test (15 points)

The team will run the HPCG test on their own hardware, aiming at highest possible efficiency under 3kw-power budget.

The proposal should include descriptions of the software environment (operating system, complier, math library, MPI software, HPCG version, etc.), the testing method, performance optimization methods, performance estimation, problem and solution analysis, etc. In-depth analysis on HPCG algorithm and the source code is recommended.

The HPCG software can be downloaded from:
http://www.hpcg-benchmark.org/software/index.html
Successful verification and optimization of HPCG on hardware platforms will be given additional scores. However, teams without the necessary hardware platforms are also encouraged to submit their thoughts and analysis.

3. The MASNUM_WAM Test (20 points)
The application is the surface wave model named MASNUM Wave Numerical Model (Abbreviation: masnum_wam). Similar to the HPCG test, the team shall run the MASNUM_WAM test on their own hardware to verify the correctness and to achieve good performance and efficiency.

The proposal document shall include the description of the testing software environment (operating systems, compliers, math libraries, MPI software and application software, etc. with version information), the testing methods, performance optimization methods, performance estimation, problem and solution analysis, etc. In-depth analysis into MASNUM_WAM's algorithm and source code is highly encouraged.

As MASNUM_WAM provides different workloads that demonstrate different performance features, in this contest, the teams should focus on the two MASNUM_WAM workloads included in the software package. The MASNUM_WAM software package can be downloaded on the remote testing platform.

Teams without the required hardware platforms are also encouraged to submit their thoughts and analysis.

4. Optimization of the DNN program on the CPU+MIC Platform (40 points)
The teams are required to conduct performance optimization of the DNN program based on the standalone hybrid CPU+MIC platform.

Application background: Deep Neural Network (DNN) is a deep learning algorithm, which has been successfully applied in many research domains, such as speech recognition and image recognition.

The DNN used in this test consists of eight layers, including an input layer, six hidden layer,

and an output layer. The detailed network structure is shown in Figure 1. The algorithm includes three major parts: the forward calculation, the error back propagation, and weight update.

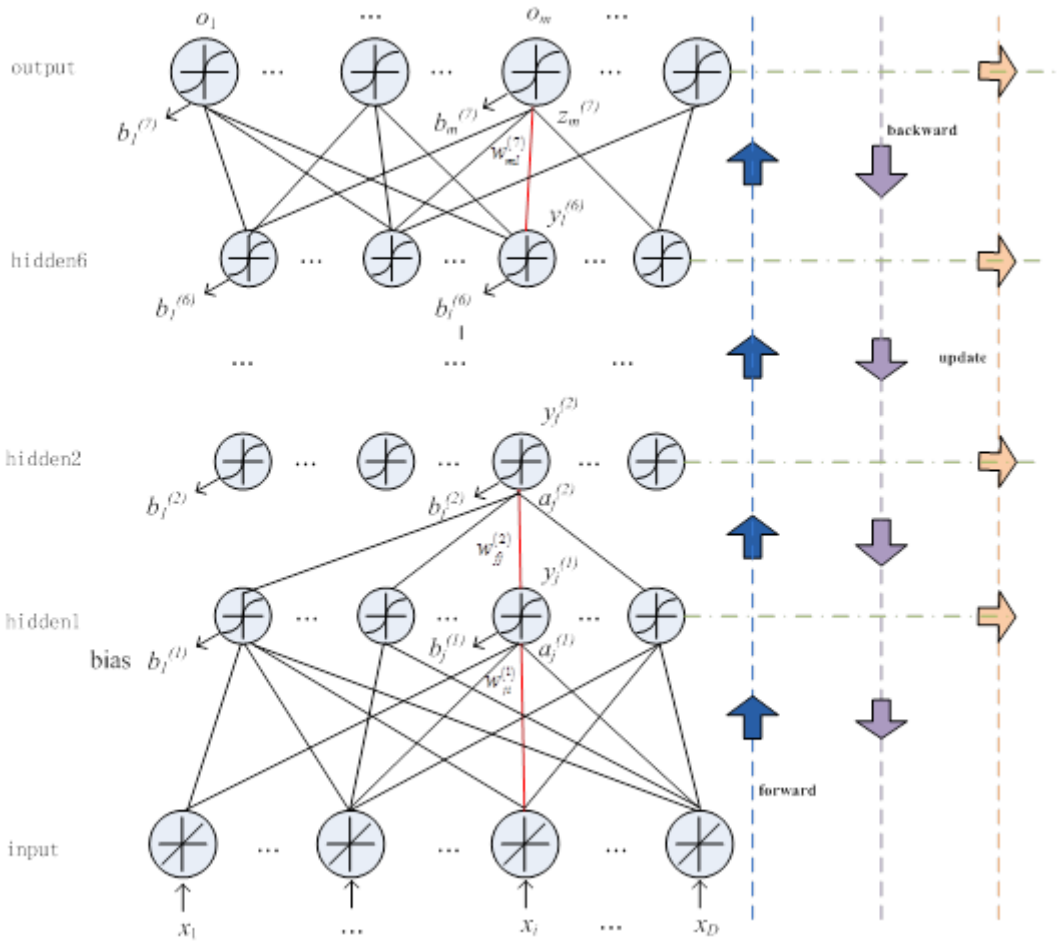

Figure 1. DNN structure

Key Words: DNN speech recognition and image recognition

a) Introduction to the application program

Program can be downloaded on the remote testing platform

(1) The entire package includes:

dnntk_src	baseline program note: This part is the DNN training code, which requires MIC optimization and the source code of other folders are not allowed to modify.	
dnn_cvtk_src	verification program	
dataset	lab_tr .pfile	acoustic label for training set
	fea_tr.pfile	acoustic feature for training set
	lab_debug.pfile	subset of acoustic label for debugging

	fea_debug.pfile	subset of acoustic feature for debugging
	lab_cv .pfile	acoustic label for cross-validating set
	fea_cv.pfile	acoustic feature for cross-validating set
	train.norm	mean file
	mlp.0.wts	initial model
exp	dnn_config_debug.cfg	workload1(for debugging)
	dnn_config_tr.cfg	workload2
	dnn_config_cv.cfg	cross-validating workload
	train.sh	running script
	crossvalid.sh	validating script

(2) compiling and running

- cd dnn_toolkit/dnntk_src
- make
- cd dnn_toolkit/exp
- sh train.sh

(3) cross validation

- cd dnn_toolkit/dnn_cvtk_src
- make
- cd dnn_toolkit/exp
- sh crossvalid.sh

b) Requirements for preliminary contest

i. The proposal should include the description of software and hardware environment, parallelization design methods, performance optimization methods, testing process and results on the CPU+MIC platform. In-depth analysis regarding principles, parallel algorithm and codes are recommended.

ii. After optimization, the final program should be tested with the workload2 on one computing server in the CPU+MIC hybrid cluster (the remote testing platform) provided by the organization committee. The CPU+MIC hybrid cluster consists of 4 computing servers. The performance analysis in your proposal should be based on the results of this test. Each team is required to pack and submit folder of "dnntk_src" and "exp" of this test to ASC committee.

c) Specific notes

i. ASC committee provides the remote testing platform that includes CPU and MIC

cards. The detailed information of the testing platform is provided in "Appendix B. Description of the remote testing platform". Hardware configuration of the platform is fixed.

ii. The original code is written in C. The revised code should include appropriate comments.

iii. The program can be run on either CPUs or the combination of CPUs and MICs. You may use parallel programming methods such as MPI, OpenMP, pThread and OpenCL to write your code, however, all methods should be supported by MIC. If the program utilizes the computing resources of the MIC cards, you must use the MIC offload programming mode.

iv. The optimization methods must not violate the basic DNN algorithm that is used in the original code.

v. The optimization methods used must be independent of the initial conditions.

vi. The result must be gotten after training all data of workload2.

vii. The result "accuracy" saved in the "exp/mlp_cv.0.log" is the indicator of the correctness.

- Correctness verification requirement:
  - workload1 : accuracy ⩾16.00.
  - workload2 : accuracy ⩾19.00.

viii. The result "total time cost" saved in the "exp/mlp.0.log", is the indicator of the performance.

This application will also be tested in the final contest, but on a larger CPU+MIC hybrid cluster.

Appendix B. The Remote Testing Platform

For the detailed information of the remote testing platform, we will send you the instruction manual and the login information after your registration at www.asc-events.org.