

Survey-based Term Project

CS 5463

The goal is to choose a suitable topic, in consultation with the instructor, perform *exhaustive* literature search of the recent material (proceedings, journals, theses/dissertations and technical reports), catalog published material on the chosen topic, browse through the papers and read the important ones, classify the results obtained so far, and write a survey paper on the state-of-the-art the research on the chosen topic. Use ACM Computing Survey papers as guides for style, content, and level of detail (check out samples in the ACM's digital library accessible through UTSA library).

The final survey paper should typically report on (i) 4 foundational papers, (ii) 6 most recent (and relevant) journal papers and (iii) 10 most recent and relevant conference papers to convey the state-of-the-art techniques and knowledge. Other relevant papers are lightly referred to and described.

Course Website: Each student sets up a web site or GitHub for this survey, where all components are to be posted by the following deadlines – ppt/word copies need to be submitted to the instructor and TA as well. For all online references cited, have links available on this site. Use this site to also post and email your presentations a week before your presentation for review. Send a link to your course site within a week.

Deadlines:

- **Topic Selection:** Feb 26

Submit a half-page write-up defining the scope of your survey. Also, by this date, post the write-up at your course site.

- **Bibliography of literature found:** Mar 5

This may be a partial list to be complemented as the literature search continues. Have links to these references on your web site.

- **Annotated Bibliography of the literature found:** March 19

(Scan through the papers and write a brief comment on its content not exceeding 4-5 lines - not from their abstracts/intro. Identify 25 to 30 main papers to be read more thoroughly.)

- **Detailed Annotated Bibliography and Classification of the Results:** April 2

(i) Detailed comments on papers read thoroughly. (ii) Classification scheme should be a natural one which makes it easier to understand the major developments in an area, and identifies the sub-hierarchies. For each class of major result obtained on the chosen topic, identify the primary and secondary papers associated. The classification scheme will yield the organization of the survey paper.

- **Survey Paper:** Apr 28

Start with an abstract, explain the topic/problem and define basic terminologies, present various approaches taken or major results obtained justifying your classification, present each major result and briefly discuss minor results within each category giving illustrations where needed, give the current trend and future work remaining in the area, and include the bibliography. All work and explanations must be *adequately referenced* throughout the survey. Have a table of contents in the beginning.

Appendix contains (1) classification and (2) annotated bibliography.

A good survey paper would be of publishable quality.

Implementation-based Term Project

Term Project : Method Development and Implementation Option

CS 5463

Choose a suitable problem and dataset, perform a brief literature search, select three recent and competing state-of-the-art parallel/distributed deep learning training algorithms or method optimizations, and implement them on CUDA and/or distributed memory platform (or extend these functionalities in a DL framework). Study their performances (parallel as well as DL-based), perform fine tuning, and write an implementation based paper describing the problem, major approaches, selected algorithms/techniques with justifications, implementations details and performance tuning, performance plots, discussion of plots, and possible future work and your conclusions. A plus would be to come up with your own algorithm (either theoretical or practical).

A good implementation paper would be of publishable quality.

Due Dates:

- Initial half-page writeup containing problem statement: Feb 26
Link to web site with writeup posted.
- Bibliography and a brief description of your chosen algorithms/technique: March 5
Have links to all online references on your web site.
- Algorithm/Method 1: March 19
Post all files - source codes, adequately documented, and timing data files.
- Algorithm/Method 2: April 2
Meld Algo 1 writeup with Algo 2 writeup and post - to become the Implementation paper.
- Algorithm/Method 3 + Implementation paper: Apr 28

With each algorithm/method, submit (and post) the

1. A 1-2 page description (hard copy) of
 1. your problem,
 2. chosen algorithm/method,
 3. associated data structures and datasets, hyperparameters
 4. underlying communication pattern,
 5. amount of read and write contention and synchronization overheads CUDA/MPI program (or, overheads for distributed program, and in other languages)
 6. parallel time complexity for each implementation with a breakdown of communication/synchronization time and of computation time,
 7. timing and other experiment details (description of what parameters have been varied in what range, and how many runs have used for parallel and DL performance data),
 8. performance of each program with reference to the plots for (a) execution/training time and for (b) speedup as number of processes/GPUs varies, (c) training and accuracy, etc., and
 9. your conclusions containing your interpretation of the performance of these methods, their limitations, and possible future improvements.