COSC 320 Project: Algorithm Design, Implementation, and Analysis

In this project, you will choose one of the following topic, study background knowledge of the selected algorithm, understand the design of the algorithm, and implement and analyze the algorithm.

Topic I: Parallel computing

In the current fast-paced global world, information and data are growing exponentially. Processing information and data in a single-processor computer is becoming increasingly difficult. Either the size of data sets is too large for a single-processor computer to handle, or the processing speed of single processor is too slow. To go beyond the limit of the single processing power, multiple processing elements are used in parallel. A *parallel computing system* is a set of processing units, either locally located or distributed across network, that process information and data in parallel, thus can solve problems with a larger size and solve them faster. The computing systems such as parallel computing, distributed computing, and cloud computing that employ the parallel processing paradigm will become a mainstream in the foreseeable future.

In this project, you will study basic parallel computing background, design parallel algorithms, and implement parallel algorithms.

Part   1: Read parallel computing tutorials from Lawrence Livermore National Laboratory: https://computing.llnl.gov/tutorials/parallel_comp/ (or see the attached .PDF file if you cannot open the link).

Part   2: Design and implement an algorithm (you know or you learned) in parallel. You can implement your algorithm using any existing parallel programming language (but need to give reference in your report)

Part   3: Analyze the speedup of your parallel algorithm compared with sequential one, demo your results, and present your project.

Part   4: (extra credits) Apply and implement your parallel algorithm to real-world applications.

Topics II: Machine learning algorithms

Machine learning (ML) is a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention.

In this project, you will study basic machine learning background, techniques, and related language, and implement one ML algorithm.

Part   1: Read machine learning tutorials (examples: https://machinelearningmastery.com/a-tour-of-machine-learning-algorithms/;   https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/)

Part   2: Design and implement a machine learning algorithm. You can implement your algorithm using any language you choose.

Part   3: Analyze the algorithm performance, demo your results, and present your project.

Part   4: (extra credits) Apply and implement your machine learning algorithm to real-world applications.

Evaluation Criteria:

- Project report (5-10 pages): 100%
    - Writing style: 10%
    - report contents: 30%
    - Design of algorithm: 20%
    - Implementation of algorithm: 20%
    - Analysis of algorithm: 20%

- Presentation (about 20 minutes presentation, 5 minutes Q & A): 50%
    - Organization of talk: 10%
    - Design of slides: 10%
    - Clarity of speaking: 10%
    - Demo of algorithm: 10%
    - Response to questions: 5%
    - Evaluation/report of other group presentation: 5%

Submission:

- Progress report (algorithm you are going to implement, what you have done, and what you plan to do): Oct 23
- Presentation slides (ppt) due and presentation date: See below (submit .ppt file though MyClasses @ SU and hand in hardcopy slides)
- Project report and evaluation other people's presentation: Dec 6

Nov 20 Dunn; Zayd	Nov 22 Lucas; Patel
Nov 25 Pearson; Reddersen	Dec 2 Sharer; Weitman
Dec 4 Wolf	