Sankalp Bose

Email : sankalpb@iitk.ac.in, bose.sankalp@gmail.com
Phone : +91 9450343133
Address: F-314, Hall 8
IIT Kanpur,Kanpur - 208016, UP, India

Education

Degree	University/Board	CPI/Percentage
Master of Technology	IIT Kanpur	9.5/10
Bachelor of Technology	IIT Kanpur	8.1/10
Intermediate	ISC	92%
High School	ICSE	91%

Technical Skills and Coursework

Programming Languages, Tools, Platforms : C++, Java, C, Python, GDB, Web Services/Globus Grid Toolkit, MPI, SQL, Linux/FreeBSD/Solaris, JSP, XML, XSL
Coursework :

Data Structures and Algorithms
Indexing and Clustering in Databases
Micro-Economics
Principles of Programming Languages
Operating Systems
Advanced Computer Networks
Discrete Maths
Parallel Algorithms
Distributed Systems
Computer Architecture
Databases
Theory of Computation

Work Experience

- **Research Trainee - Helsinki Institute of Information Technology, Finland (May-July 2007)**
  Supervisor: Dr. Andrei Gurtov, Senior Researcher
  Porting of Linux implementation of Host Identity Protocol to Symbian (C code base of over- 40,000 lines)
  – Got familiar with a code base of over 40,000 lines of code containing Linux kernel space and userspace code. Studied about the Symbian operating system and development environment called Carbide, especially issues like interrupt handling, active object framework and processreplication.
  – I made crucial changes to the code like implementing Symbian compatible wrappers for select() and fork() system calls.
  – We succesfully completed the compilation phase of the project on schedule.
- **MTech. Thesis - IIT Kanpur; ISRO, Space Applications Centre, Ahmedabad (May 2007-ongoing)**
  Supervisor : Dr. R. Ramakrishnan, Dr. Phalguni Gupta
  A Grid Computing Platform for Image Processing Applications (Java, Globus GT4)
  – I am working (individually) on Grid Enabling an already existing Web services based image processing application for use in processing geological data at ISRO.
  – I have designed a system based on open standards like OGSA, GridFTP, GRAM as to create a robust and reliable and efficient system for distributed computations required for processing of satellite data.
  – I will be implementing web services based components for remote invocation of programs and endianity aware file tranfer using the Globus Grid Toolkit
- **Teaching Assistant, Data Structures and algorithms Course (May 2007-ongoing)**
  – Managed various activities in the **Data Structures** course consisting of 150 students.
  – Responsibilities included advising weak students, designing assignments etc.

Major Projects

- **Answering Reverse Nearest Neighbour Queries for High Dimensional Data**
  –Reverse Nearest Neighbour are database queries that find application in areas such as data streaming, bio-informatics, multimedia etc.
  – In this project we approached the problem of answering RNN queries for high dimensional datasets. We built a prototype application for our algorithm and analysed the results.
- **Implementation of Bidirectional Elimination Algorithm for Parallel Solution of Linear Equations** :
  – We combined the Householder's reduction technique with the idea of Bidirectional Elimination to reduce the problem into two problems half the size.
  – Used MPI to run multiple interacting processes in parallel on a cluster machine. Could solve matrices of the order of 4000*4000.
  – Achieved speed-ups of upto 4 times as compared to a sequential program.

- **On Distributed CDS construction for Asymmetric Networks and its applications to Sensor/Ad-Hoc Networks**
  - A connected dominating set has special properties that make it suitable for applications such as energy efficient routing in Ad-Hoc networks. In this work, we presented ideas for the CDS problem which is essentially a graph-theoretic problem and gave centralised and distributed solutions to the problem that could be directly applied to a Sensor network.
  - Succesfully demonstrated the algorithm using simulation over a cluster of machines using MPI.
- **Fortran 95 compiler (C++, 5000 lines)**
  - Written using C++, Lex, Yacc, to compile programs in the ADA 95 language to MIPS assembly code.
  - Correctly compiles programs containing constructs like arrays, if statements, switch statements, loops, console I/O.
- **A Game-Theoretic Framework for Co-operation Enforcement in Mobile Ad-hoc Networks**
  - In this work we have modeled nodes in an Ad-Hoc network as rational players which make forwarding decisions by optimizing between its two primary objectives, Lifetime and Service Availability.
  - We gave a framework for co-operation and proved via Nash Equilibrium analysis that the most suitable action for a rational player in our framework would be co-operation in Ad-Hoc routing.
- **User level Thread Library with mutual exclusion support**
  - Implemented user level thread library taking care of issues like scheduling, starvation and fairness.
  - Implemented various distributed mutual exclusion algorithms (non-token and token based) and measured throughput and synchronization delays for each of them.
- **Counting Cars in a Traffic Video using Haar Cascades**
  - We used a recent algorithm for object detection using Haar Cascades for distinguishing cars from other moving objects in the traffic. We combined the object detection algorithm with the Kalman tracking algorithm to determine the number of cars passing through a busy road.
  - Extensively used OpenCV Image processing library.
  - Achieved frame rates of almost 18 frames per second.
  - This work was cited at a few places for its novel approach and good results.
- **Detecting motion using adaptive Gaussian Mixture Models**
  - Applied continously adaptive Gaussian Mixture Model as a learning technique to detect motion in a sequence of frames.
  - Used a number of image processing routines like background subtraction, noise reduction, erosion, dilation to improve the quality of detection.
- **Semantic searching of documents sans Tagging**
  - We developed a prototype system for semantic searching of documents over the web.
  - The semantic capability was achieved by extracting key words using OpenCalais web service and augmenting the search phrase with ontologically similar words given by WordNet Thesaurus.
  - We also implemented an AJAX based user interface using the GWT.
- **Hardware based Design Solutions for implementation in a Telemedicine Utility** Developed hardware solutions for image compression and de-compression on Altera DE-2 FPGA board using Verilog. Also used ModelSim extensively for simulation purposes.
- **Implementation of SDLX Architecture on a Xilinx FPGA** : We implemented SDLX architecture in Verilog and tested on a Xilinx Spartan-3 board.
- **A network performance measurement tool (C, 1300 lines)** : measures UDP, TCP throughput and UDP loss. (2006)
- **Extension of Nachos (C)** : Implemented multitasking, scheduling, syscalls, virtual memory etc on top of a primitive OS.
- **Pipelined MIPS R-3000** Enhanced multi-cycle MIPS model to a pipelined one with full bypass hardware and one branch delay slot.
- **Simulation of Electronic Circuits (Java, 1000 lines)** : Developed a Java package to analyze LCR circuits. (2005)

Achievements/Other Activities

- Won **1st prize** in the circuit designing competition Leviathon at IIT Kanpur.
- Reading, writing and speaking ability in **French**.
- **All India Rank 312** (top 0.17%) in the IIT JEE, the exam for admission to the IITs.
- Was placed in **top 0.1%** among about 0.2 million candidates in the AIEEE.
- Was among top 30 students in SEE-UPTU '04 out of about 1 lakh students.