GSoC'19 Project Proposal for AIMA-java

Organization: Aimacode

Project: Java Algorithms

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Basic Information

Name and Contact Information

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- **Country/Region**: Roorkee, India
- **Timezone**: UTC +05:30

University and Current Enrollment

- **University**: Indian Institute of Technology, Roorkee
- **Degree**: Bachelor of Technology (B.Tech)
- **Field of Study**: Electrical Engineering
- **Expected Graduation Year**: 2021

Meeting with Mentors

- **Before 10 May**: Reachable anytime between 3:30 am to 7:30 pm (UTC) [9:00 am to 1:00 am IST] through Email/ Gitter.
- **After 10 May**: Reachable anytime between 4:30 am to 8:30 pm (UTC) [10:00 am to 2:00 am IST] through Email/ Gitter.

   Can join a planned video session if required.

Pre GSoC Involvements with AIMA Java

Link to my [issues](#), [PRs](#) .
Here's the list of PRs/discussions made so far in aima-java.

- ❖ [#426](#) **(Merged)** - This PR adds explanations of Breadth First Search and Uniform Cost Search algorithms and their demonstrations on Romania Map problem in Classical search notebook.

- ❖ [#433](#) **(Merged)** - This PR adds rest of the uninformed searches and all the informed search strategies and their demonstrations solving the 8 Puzzle problem in Classical Search Notebook.

- ❖ [#446](#) **(Open)** - This PR adds an explanatory notebook for the 4th chapter (Beyond Classical Search) of the textbook. It contains demonstrations of local search algorithms using 8 queens problem, searching in partially observable and non-deterministic environments, and online search algorithms.

- ❖ [#448](#) **(Open)** - This PR adds an explanatory notebook for the 5th chapter (Adversarial Search) of the textbook. It contains the demonstrations of Minimax decision and Alpha-Beta search algorithms using the TicTacToe game.

- ❖ [#450](#) **(Open)** - Currently, the implementation of [GraphSearch](#) in AIMA4e branch does not follow the updated [pseudo code](#). Hence, this PR updates the GraphSearch.java according to the updated pseudo code.

- ❖ [#452](#) **(Open)** - This PR updates the implementation of Genetic Algorithm in AIMA4e branch as per the updated pseudo code.

- ❖ [#455](#) **(Open)** - Currently, the CSP notebook is incomplete. Hence, this PR updates the explanation of constraint propagation and adds the demonstrations of backtracking search, local search, and tree CSP solver algorithms using Map-coloring problem to the CSP notebook.

Project Proposal

Currently, this project is targeted towards the fourth edition of the book. There are plenty of APIs which are yet to be implemented in the AIMA4e branch. To be precise, the Problem Solving section is already been implemented. Though there are subtle changes and minor additions which are yet to be done in this section. The "Knowledge, reasoning and planning" section and "Uncertain knowledge and Reasoning" section was partially implemented last year. Implementation of the "Learning" section is not initialized yet.

Therefore, as a part of my GSoC proposal, I plan to implement the **Learning** section of the textbook. Depending on the advice from the mentor, I would also be interested in making APIs for the **Knowledge, reasoning and planning** and **Uncertain knowledge and reasoning** sections of the textbook for AIMA4e branch. I also plan to add the explanatory notebooks for these sections. I've already worked on some notebooks before, hence would love to contribute to the same.

Besides this, I plan to write the tests for updated algorithms of the fourth edition and demonstrate these on the various problems as done in the [demo](#) package of aima3e branch.

Here is the list of algorithms I wish to implement along with the proposed timeline.

Proposed Timeline

Present - May 6	- Update algorithms as per the updated pseudo code of 4th edition. - Ch. 5 (Adversarial Search) - Ch. 6 (Constraint satisfaction problem) - Complete notebooks for Chapter 5,6. (This period involves my end term examinations, so I've to devote some time to academics. Hence, I'm keeping this period relatively lighter)

May 6 - May 20	• Implement the changes in
	   ○ Ch. 7 (Logical agents)
	   ○ Ch. 8 (First Order logic)
	   ○ Ch. 9 (Inference in first-order logic)

May 6 - May 20	• Start making API for Chapter 10 (Classical Planning) • Implement GraphPlan algorithm
May 20 - May 31	• Implement Hierarchical search • Angelic Search
June 1 - June 10	• Complete Knowledge, reasoning and planning section of the textbook with their tests.
Phase-1 Evaluation	**Above stated algorithms**
June 11 - June 27	• Start making APIs for learning section.
June 28 - July 8	• Implement Decision Tree Learning • Model Selection
July 8 - July 22	• Decision list learning • Ada boost learner
Phase-2 Evaluation	**Above stated algorithms**
July 23 - Aug 5	• Complete the testing suite for Chapter 18 (Learning from examples) • Start making APIs for Chapter 19 (Deep Neural Networks)
Aug 6 - Aug 19	• Implement Adam Optimizer • Integrate some deep learning libraries for java such as DL4J or ND4J, for 19th Chapter.
Aug 19 - Sept 2	• Complete the testing suite for the above algorithms. **Submission of code for final evaluations**

About Me

I am a second-year undergraduate student majoring in Electrical Engineering at the **Indian Institute of Technology, Roorkee**. I was introduced to programming in my freshmen year of college. Since then I've been actively contributing to various projects.

Link to projects: here

I'm an active member of **Mobile Development Group, IITR**. Being a part of this group, I've worked on several Android projects. Some of them are as follows:-

1. **Graph-Kit** : This is an Android library for plotting and editing graphs. This library allows you to plot different kinds of graphs from data points. The currently supported graphs are Line Graph, Bar Graph, and Pie Chart. This library also includes an EditGraphView in which you can edit the graph by dragging points and also get normalized points from the curve. My motivation to pursue this project was to explore the basics of Android Graphics. Through this project, I've learned a lot of things including Paint and Canvas used to draw graphics in Android.

   Link to the project: Github

   Here are some screenshots of this library:
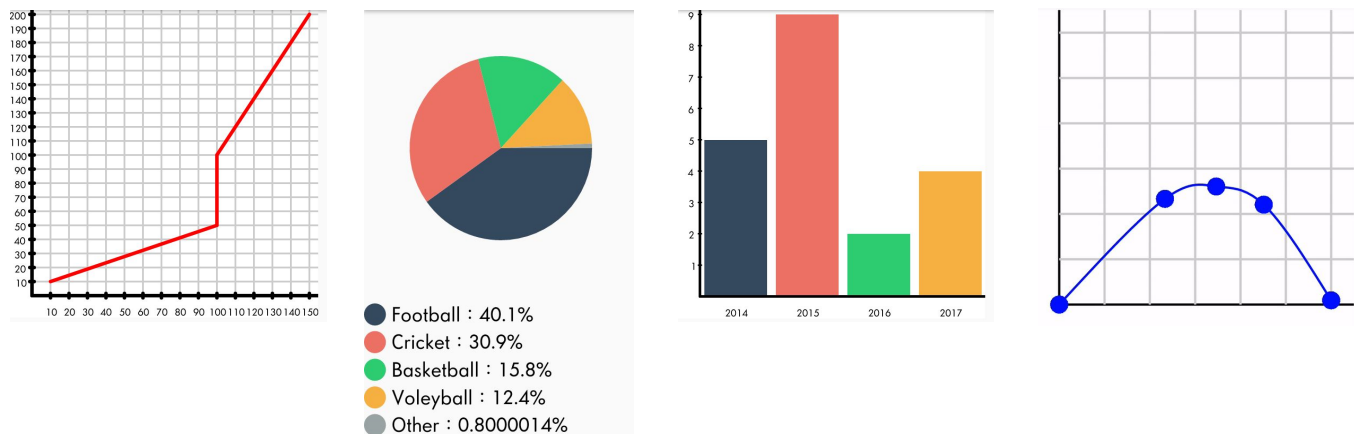
2. **<u>Convocation IITR</u>** : I have been a part of the developer team for the official Android app for the Convocation Ceremony 2018. This app was for IITR graduates, to help them access the information related to their degrees, details regarding the ceremony or enjoying the live stream of ceremony right from the app.
Link to the project: Github , Google Play

3. **<u>Cognizance'19</u>** : Cognizance is the TechFest of IITR (Second largest tech-fest of Asia). I was one of the developers of the official Android app for the Cognizance 2019.
Link to the project: Github , Google Play

Besides this, I've participated in several hackathons. I would like to mention some of them.

- **<u>InOut 5.0</u>** : We in a team of three have developed a road monitoring system which focuses on providing better road experience especially for old people and patients in India. It is based on the indigenous algorithms built for data calculation on android phones. We used the gyro sensor and accelerometer of the mobile phone for the readings and plotted Z v/s time to produce the results.
 Though there are many research papers and products around in the market which are working in the same direction but:-
  - Most of them are taking data using an attachment to the vehicles which is expensive as well as infeasible to be installed in such a large number of automobiles.
  - Also, there are no good algorithms available for the real-time monitoring of road and producing results.

  Secured a position among top five contestants.
  Here are some screenshots of the app.
  Link to the project: Github .
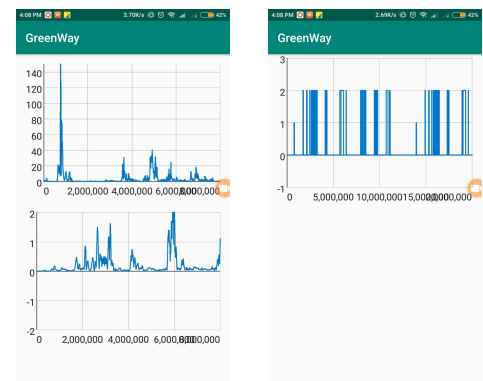
- **Hack In The North 4.0** : We in a team of four have developed the old popular Duck Hunt game in augmented reality.

  As we've enjoyed our childhoods playing the really fun games like Super Mario, Duck Hunt, Contra, etc, so our motive for this project was to recreate that feeling in today's generation and bring the nostalgia for the old retro games. This can also be a source of inspiration for today's generation to get into game development by showing them how some of the simplest games with the simplest ideas can change the world.

  Secured third position.

  Link to the project: here .

  Here's a screenshot of the game.

I'm also passionate about competitive programming. I love reading and implementing new algorithms for various problems. I've been actively participating in various competitive coding contests since last year.

Here are the links to my competitive profiles: Codeforces , Codechef

Coding Skills

- I'm comfortable with JAVA and its various libraries with a sound knowledge of OOP concepts which are to be used in this project.
- Fluent in C++.
- Moderate knowledge in Python aided with a bit of googling.

Development Environment

- IntelliJ IDEA with JDK 1.8 installed on Ubuntu 16.04 LTS.

Why Me for this Project?

I'd started reading this book in last summers. Since then I've developed my interest and passion for this book. I loved reading new algorithms and solving the maths behind them. Initially, I started implementing these algorithms from scratch ([link](#)). Then I started contributing to AIMA, wrote some notebooks, and explored various problems and some new algorithms to solve them. It's almost been a year now studying about AI and I deeply feel attracted towards this field and want to pursue it in the future. I've contributed to this project in the past and have attempted to implement some algorithms in the 4th edition as well. Hence, I've got sufficient introductory knowledge of the codebase so as to contribute further. Besides this, I've been working on various Android projects for the last one and a half years. So, I feel confident with the specifics of Java. This makes me eligible to apply for the AIMA-Java project.

Now I'm looking forward to reading the book further and adding the remaining implementations to the code repository.

Other Commitments

I have my end term examinations from 24 April to 4 May. So I'll be a bit inactive between 10 April to 4 May which is way before the official coding period. My vacations start on 10 May and end on 11 July, and the official GSoC period is from 6 May to 26 August. I can easily devote 45-60 hours a week until my college reopens and 30-40 hours per week after that. I'm also free on the weekends and I intend to complete most of the work before my college reopens.

I have no other commitments planned for the summer. I shall keep my status posted to all the community members and maintain transparency in the project.