<u>COMP 6776: Project Proposal</u>

Solving System of Linear Equations using Evolutionary Algorithm

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Genetic Algorithm for System of Linear Equations

In the past few decades, several direct and indirect *methods (Gauss Elimination Method, Gauss Jordon Method, Jacobi's Method and Gauss Seidal method, etc.)* have been introduced to solve system of linear equations in mathematics point of view. Here direct methods give us the exact root for given system of equations and indirect method give us an approximate root for the given system after a couple of iterations. We believe that we can even solve these equations using G.A rather than these heuristic methods and reason is that it is

- One of the most effective and efficient approach
- It works on a population of possible solutions, while other heuristic methods use a single solution in their iterations and it is not a deterministic but a probabilistic one.
- Rapidly converge to near-optimal.
- Avoid the problem of rounding errors and inverting large matrixes.

Future Task

In this project we will solve system of linear equations as optimization problem by using the techniques of Genetic algorithm and compare the competence and efficiency of our algorithm with the above defined numerical methods. Here, the genetic algorithm approach follows the concept of solution evolution by stochastically generating the solutions (generations of population) using a definite fitness function to determine the best fit solution (survival of the fittest). The roots of these linear system of equations using GA is estimated using population size, degree of mutation, crossover rate and coefficient size.

The Proposed system of equation's that we are planning to solve using G.A algorithm will be of this kind:

$$
\begin{gathered}
a_{11}x_1 + \ a_{12}x_2 + \cdots \dots \dots \dots \dots \dots . a_{1n}x_n = b_1 \\
a_{21}x_1 + \ a_{22}x_2 + \cdots \dots \dots \dots \dots \dots . a_{2n}x_n = b_2 \\
a_{31}x_1 + \ a_{32}x_2 + \cdots \dots \dots \dots \dots \dots . a_{3n}x_n = b_3 \\
. \\
. \\
. \\
a_{m1}x_1 + \ a_{m2}x_2 + \cdots \dots \dots \dots \dots \dots . a_{mn}x_n = b_m .
\end{gathered}
$$

Here, the $x_i's$ are variables and $a_{ii}'s$ are variable coefficients and $b_i's$ are constants.

In order to solve such equations using genetic algorithm we first need to convert them in objective function and find the solution that satisfies all equations simultaneously and then we will max/ min our fitness function.