

Project Proposal
Computing Course, Dr. Sourendu Gupta

Time complexity of matrix factoring algorithms

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Matrices play a huge role in solving equations numerically, in a systematic way. Matrix manipulations usually can be done more easily by factoring the given matrix in various ways. The matrix can be huge for a particular problem of interest and in such cases the time complexity and space complexity of the algorithm used, is of utmost importance. The computing cost (time, money and storage) of manipulation of such matrices can be reduced by analysing various algorithms.

This project will study various **decomposition** algorithms and special cases and their time complexities.

LU Decomposition is basically Gauss elimination. The algorithms to be studied are **Doolittle algorithm, Crout and LUP algorithms** and **Sparse matrix decomposition (SVD)**.

In the process, the project will study special matrices for which the time complexity can be reduced with help of different algorithms. Some of the special cases that will be studied are:

**Tridiagonal and Band Diagonal,
Singular Value Decomposition,
Vandermonde and Toeplitz Matrices,
Cholesky Decomposition**

The project will also intend to study the complexities of basic matrix manipulation like matrix multiplication and inversion and look into algorithms like Strassen algorithm that reduce the time complexity of matrix multiplication from $\mathcal{O}(N^3)$ to $\mathcal{O}(N^{2.807})$.

References: Numerical recipes: art of scientific computing, William H. Press