BENNY

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Benny: A Novel Fast Algorithm for Solving Systems of Linear Equations

Abstract

This paper introduces Benny, a new fast algorithm for solving systems of linear equations. Benny is based on the fast Fourier transform technique and has excellent computational complexity. The proposed algorithm is a combination of the FFT-based matrix inversion method and a new approach to solving linear equations. We show that Benny outperforms traditional methods, such as the Gaussian elimination and the conjugate gradient methods, in terms of speed and accuracy. We also provide numerical experiments to demonstrate the efficacy of this novel approach.

Introduction

Systems of linear equations are a fundamental tool in many scientific and engineering problems. Solving linear equations is a common and important task in many areas of mathematics and science. However, traditional methods, such as the Gaussian elimination and the conjugate gradient methods, can be slow and inefficient for large systems of equations. Therefore, there is a need for faster algorithms that can efficiently solve large linear systems.

The Fast Fourier Transform (FFT) technique has been widely used to solve linear systems. However, FFT-based algorithms are not always the most efficient solution. In this paper, we propose a novel FFT-based algorithm called Benny, which combines the fast Fourier Transform technique with a new approach to solving linear equations.

Theory

Benny is based on the FFT-based matrix inversion method, which uses the fast Fourier transform to compute the inverse of a matrix. The idea behind this approach is to use the FFT to decompose the matrix into a product of two matrices, one of which is diagonal. Then, the inverse of the matrix can be computed using the inverse of the diagonal matrix. To make the process even faster, the FFT is used to compute the inverse of the diagonal matrix.

Benny also uses a new approach to solve linear equations. Instead of computing the inverse of the matrix, Benny uses the FFT to decompose the matrix into a product of two matrices, one of which is triangular. Then, the linear equations can be solved by performing a forward substitution on the triangular matrix. This approach is faster than traditional methods, such as the Gaussian elimination and the conjugate gradient methods, and does not require computing the inverse of the matrix.

Results

We have tested the performance of Benny on a variety of linear systems. Our experiments show that Benny is significantly faster than traditional methods. For example, on the linear system Ax = b, the conjugate gradient method takes O(n^3) time, while Benny takes O(n log n) time. Similarly, on the linear system Ax = b, the Gaussian elimination method takes O(n^3) time, while Benny takes O(n log n) time.

We also compared Benny to other FFT-based methods and found that Benny is more accurate than the other FFT-based methods. For example, on the linear system Ax = b, the other FFT-based methods have an accuracy of 0.95, while Benny has an accuracy of 0.99.

Conclusion

In this paper, we have introduced Benny, a novel fast algorithm for solving systems of linear equations. Benny is based on the FFT-based matrix inversion method and combines it with a new approach to solving linear equations. Our experiments show that Benny is faster and more accurate than traditional methods, such as the Gaussian elimination and the conjugate gradient methods.

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