On the Complexity of Matrix Inversion

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Abstract. We prove a lower bound of $Omega(n^2log(n))$ for the time complexity of calculating the inverse of a matrix nxn, over the real or complex numbers in the sequential computation case.

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Theorem 1. *The lower bound for the computational time complexity $I(n)$ for the inversion of a matrix of size nxn is $\Omega(n^2logn)$.*

Proof. It has been shown a) that the theoretical speedups of matrix multiplication of two nxn matrices $M(n)$ translate to speedups for matrix inversion, i.e. $I(n) = \Theta(M(n))$ [1], and vice versa. The lower bound of matrix multiplication of two nxn matrices is $\Omega(n^2log(n))$ [2]. The proof follows by deduction.

References

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2. Ran Raz. On the Complexity of Matrix Product. *SIAM Journal on Computing*, 32(5):1356–1369, 2003.