Space complexity of matrix inversion, determinant and adjoint

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I want to check the space complexity of

- matrix inversion,
- matrix adjoint and
- matrix determinant.

Most of the literature mention the time complexity (for the inversion there are $O(n^3)$ solutions and for the determinant $O(n^4)$ and $O(n^3)$). But I haven't been able to find literature where mentions the space complexity for these three operations.

Do you guys know any good references covering the **space complexity** of some algorithms for these operations ?

Thank you.

algorithm time-complexity complexity-theory space-complexity matrix-inverse Edit tags

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asked Jul 6 '20 at 3:19

liwuen
163 10

You can use Gaussian elimination (assuming there are no precision issues) to find both an inversion and a determinant, and it requires O(n^3) time and O(n^2) space. Since the output for inversion requires O(n^2) space, it's space-optimal for this operation. – user12463032 Jul 6 '20 at 3:57

some special matrices (like orthonormal rotational and homogenuous transform matrices) can be inverted in-place so `O(1)` space using transposing of rotation part of matrix and correcting the rest by simple `matrix*vector` multiplication. However standard approach complexity heavily depends on the implementation. – Spektre Jul 6 '20 at 7:08

@Spektre neither transpose nor matrix multiplication are O(1) – dmuir Jul 6 '20 at 7:18

@dmuir transpose is `O(1)` space its done inplace so the result is already allocated. but youre right `matrix*vector` is `O(m)` space where `m` is dimensionality of the space the matrix represent usually `m=n-1` where `n` is size of square matrix. here example `matrix_inv` for 4x4 3D matrix – Spektre Jul 6 '20 at 7:21