Applications Of Matrix Algebra

Applications of SVD in Linear Algebra

- Inverse of a $n £ n$ square matrix, $\mathbf{A}$
  - If $\mathbf{A}$ is non-singular, then $\mathbf{A}^{-1} = (\mathbf{U\Lambda V}^T)^{-1} = \mathbf{V\Lambda}^{-1}\mathbf{U}^T$ where $\Lambda^{-1} = \mathrm{diag}(1/\lambda_1, 1/\lambda_1, \cdots, 1/\lambda_n)$
  - If $\mathbf{A}$ is singular, then $\mathbf{A}^{-1} = (\mathbf{U\Lambda V}^T)^{-1}\frac{1}{4}\mathbf{V\Lambda}_0^{-1}\mathbf{U}^T$ where $\Lambda_0^{-1} = \mathrm{diag}(1/\lambda_1, 1/\lambda_2, \cdots, 1/\lambda_i, 0, 0, \cdots, 0)$

- Least squares solutions of a $m£n$ system
  - $\mathbf{Ax=b}$ ($\mathbf{A}$ is $m£n$, $m > n$) $= (\mathbf{A}^T\mathbf{A})\mathbf{x} = \mathbf{A}^T\mathbf{b}$) $\mathbf{x} = (\mathbf{A}^T\mathbf{A})^{-1}\mathbf{A}^T\mathbf{b} = \mathbf{A}^+\mathbf{b}$
  - If $\mathbf{A}^T\mathbf{A}$ is singular, $\mathbf{x} = \mathbf{A}^+\mathbf{b}\frac{1}{4}(\mathbf{V\Lambda}_0^{-1}\mathbf{U}^T)\mathbf{b}$ where $\Lambda_0^{-1} = \mathrm{diag}(1/\lambda_1, 1/\lambda_2, \cdots, 1/\lambda_i, 0, 0, \cdots, 0)$

- Condition of a matrix
  - Condition number measures the degree of singularity of $\mathbf{A}$
    - Larger the value of λ_1/λ_n, closer $\mathbf{A}$ is to being singular

http://www.cse.unr.edu/~bebis/MathMethods/SVD/lecture.pdf

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Matrix Mathematics Wikipedia
Definition. A matrix is a rectangular array of numbers or other mathematical objects for which operations such as addition and multiplication are defined. Most commonly, a matrix over a field F is a rectangular array of scalars each of which is a member of F. Most of this article focuses on real and complex matrices, that is, matrices whose elements are real numbers or complex numbers ...

Algebra Applications
In this section we will look at a couple of applications of exponential functions and an application of logarithms. We look at compound interest, exponential growth and decay and earthquake intensity.

Linear Algebra And Its Applications Matrixlabexamplescom
Linear Algebra and its Applications - Circuit Analysis One important linear algebra application is the resolution of electrical circuits.We can describe this type of circuits with linear equations, and then we can solve the linear system using Matlab. For example, let's examine the following electrical circuit (resistors are in ohms, currents in amperes, and voltages are in volts):

Rank Linear Algebra Wikipedia
In linear algebra, the rank of a matrix is the dimension of the vector space generated (or spanned) by its columns. This corresponds to the maximal number of linearly independent columns of .This, in turn, is identical to the dimension of the space spanned by its rows. Rank is thus a measure of the nondegenerateness of the system of linear equations and linear transformation encoded by .

Algebra Applications Of Quadratic Equations
Section 2-8 : Applications of Quadratic Equations. In this section we're going to go back and revisit some of the applications that we saw in the Linear Applications section and see some examples that will require us to solve a quadratic equation to get the answer.. Note that the solutions in these cases will almost always require the quadratic formula so expect to use it and don't get ...