Top Ten Algorithms Class 10

John Burkardt
Department of Scientific Computing
Florida State University

....

http://people.sc.fsu.edu/∼jburkardt/classes/tta_2015/class10.pdf

2 November 2015

Our Current Algorithm List

1. Back Propagation algorithm
2. Bank routing number checksum for error detection
3. Bernoulli number calculation
4. Bootstrap algorithm
5. Data stream: most common item
6. Discrete Cosine Transform
7. Discrete Fourier Transform
8. Euclid's greatest common factor algorithm
9. Hamming error correcting codes
10. ISBN (International Standard Book Number) checksum

Our Current Algorithm List

1. k-means clustering algorithm
2. Luhn/IBM checksum for error detection
3. Monte Carlo Sampling
4. PageRank algorithm for ranking web pages
5. Pancake flipping algorithm for genome relations
6. Path counting with the adjacency matrix
7. Power method for eigenvector problems
8. Probability evolution with the transition matrix
9. Prototein model of protein folding
10. QR (Quick Response) images and error correction

Our Current Algorithm List

1. Reed-Solomon error correcting codes
2. Ripple Carry algorithm
3. Search engine indexing
4. Trees for computational biology
5. UPC (Universal Product Code) checksum for error detection

Student Presentation

Joe McKenna, *"The QR Algorithm for Matrix Factorization"*

Given a rectangular matrix A, find an orthogonal matrix Q and upper trapezoidal matrix R such that $A = Q * R$.

The QR algorithm is one of the Dongarra and Sullivan "Top Ten Algorithms", in the category "The Decompositional Approach to Matrix Computation".

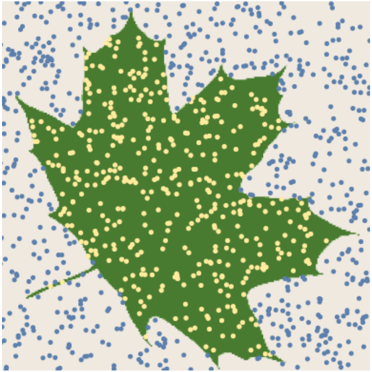
Reference by Cleve Moler at
http://www.mathworks.com/moler/leastsquares.pdf

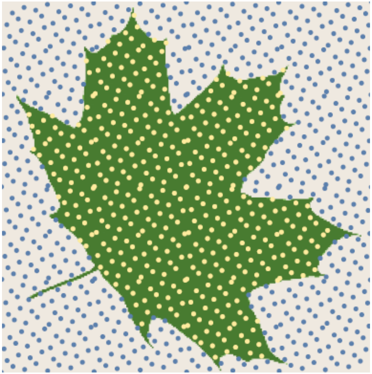
The QR algorithm can also be used to compute eigenvalues and eigenvectors, and thus it is counted, by itself, as *another* of Dongarra and Sullivan's Top Ten.

Student Volunteer - Quasirandom Numbers

Quasi-random number algorithms generate sequences of points that do a much better job of evenly sampling a line, a square, a cube or an arbitrary region.

Reference: Brian Hayes, “Quasirandom Ramblings”, merican Scientist, July/August 2011.





Student Volunteer - Signal Reconstruction

This topic is based on two articles by Cleve Moler, “Mr Matlab”, both of which try to solve a problem with insufficient data.

1) I'm thinking of two numbers whose average is 3. What numbers am I thinking of? Reference:
www.mathworks.com/clevescorner/dec1990

2) A signal of millions of values was sent. But I only received a compressed signal, containing weighted averages. Can I recover the exact original signal? Reference:
http://www.mathworks.com/tagteam/65074_91850v00_NN10_Cleve.pdf

Under the right conditions, the answer is yes.