

It's ALL in the Algorithm

George Rebane, 11 January 2000 (v2dec07)

al·go·rithm

n. Mathematics

A step-by-step problem-solving procedure, especially an established, recursive computational procedure for solving a problem in a finite number of steps.

Civilization started when our ancestors put together enough algorithms to pass on to the next generation, formalizing what was learned and successfully practiced in the last. Such formalization of someone's knowledge into a communicable algorithm allowed us to leap ahead of the glacial evolutionary learning processes that anchor the development of the lower species. And those of us who algorized better, leaped further and faster.

Modern education, especially of the non-technical kind, does not always understand the pervasive role of algorithms in making possible the world we live in – especially in such ‘non-technical worlds’ as business, politics, sociology, finance, and education in which algorization is often looked down upon. But even there things are changing.

A useful path from raw observations to wisdom may be summarized with the following sequence of definitions –

- **Data** – sets of facts and beliefs that describe the real world. All observations are captured as data.
- **Information** – data ‘formatted’ (selectively collected, arranged, and/or processed) to support specific decision making. Many information sets may be made from one data set.
- **Knowledge** – an intended collection of correct decisions or decision sequences and their supporting information that permit us to perform useful activities such as survival – in short, an algorithm.
- **Wisdom** – reliable knowledge that has survived and served over time which for its holder, when so graced, makes life a joy or at least bearable.

From this it is clear that without the algorithmic formalization of knowledge, its efficient transmittal is impossible. Without the ability to abstract and recall the algorithm we are at best reduced to ‘monkey see, monkey do’.

So it all begins with knowledge being reduced to communicable algorithms, for absent the algorithm it is not possible to -

- Work together to efficiently build things,
- Transplant a heart or lase a cornea,
- Mass produce anything,
- Measure a market,
- Teach the piano, and
- Tie a shoe.

Finally, algorithms come in all sizes, shapes, and efficiencies. The latter is especially important for it is the better algorithm that opens up new worlds using the tools at hand, and new tools using the world at hand. For over two centuries we knew the concept and several formulations of aggregate market behavior, but it was the invention of the Dow-Jones Index algorithm that efficiently summarized the performance of a large equities market and made the modern stock markets possible. We understood Bayesian estimation since the 18th century but it was the Kalman filter algorithm that let us put Man on the moon. We knew how to compute the Fourier transform of signals for over 150 years but it was the Cooley-Tukey Fast Fourier Transform algorithm that opened up the world of digital communications (e.g. Internet), modern medical imaging, and more things than we can recall.

In the social affairs of Man never disparage the algorithm, for it simply is the heart of the matter. No light bursts forth in your mind save it takes the shape of an algorithm, for without one at hand we proceed as the blind. It is all in the algorithm.