Shmuel Friedland
University of Illinois (Chicago)

Results and Problems for 3-tensors

In this talk I state some results and open problems for 3-tensors that I worked on in the last couple of years.

1. The conjectured value of the generic, (border), rank of 3-tensor and its numerical verification over **C**. What about over **R**? Very partial results.
2. Best rank one approximation.
    - Restatement of L2 rank one approximation as a maximal problem. The corresponding generalization of singular vectors and singular values. Open problem: How many critical points, i.e. singular values, are in the generic case?
    - The analogous maximal problem for any Lp, p\in (1,\infty)$ norm. The corresponding p singular vectors and singular values.
    - Surprise: Existence of Perron-Frobenius theorem for irreducible nonnegative tensors for $p=3$, and more generally for $p\ge 3$, and nonexistence of Perron-Frobenius theorem for positive tensors for $p=2$, probably for $p<3$.

3. Analogs of SVD decomposition of 3-tensors.

    - The maximal number of zero entries in 3-tensor under the orthogonal conjugation in each of 3-modes.
    - The expected limit form of the tensor under the iteration an analog of QR algorithm.
    - An analog of Kogbetliantz's Algorithm