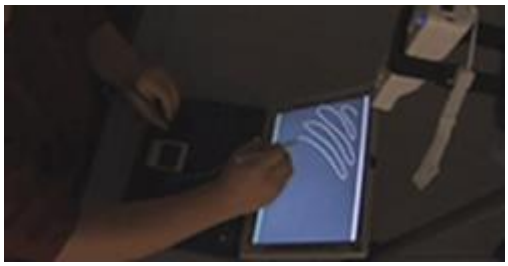
Here are some reference applications

crossfade

A line segment between points is given by the convex combinations of those points; if the "points" are images, the line segment is a simple morph between the images.

Perspective rectification

Given a photo of a whiteboard taken at an angle, synthesize a perspective-free view of the whiteboard.



The same transformation can be used in using a Wiimote to make a low-cost interactive whiteboard or light pen (due to Johnny Chung Lee).

Error-correcting codes

Error-correcting codes are used, e.g., by cellphones to preserve data transmitted over a noisy channel while maintaining high throughput.

Integer factorization

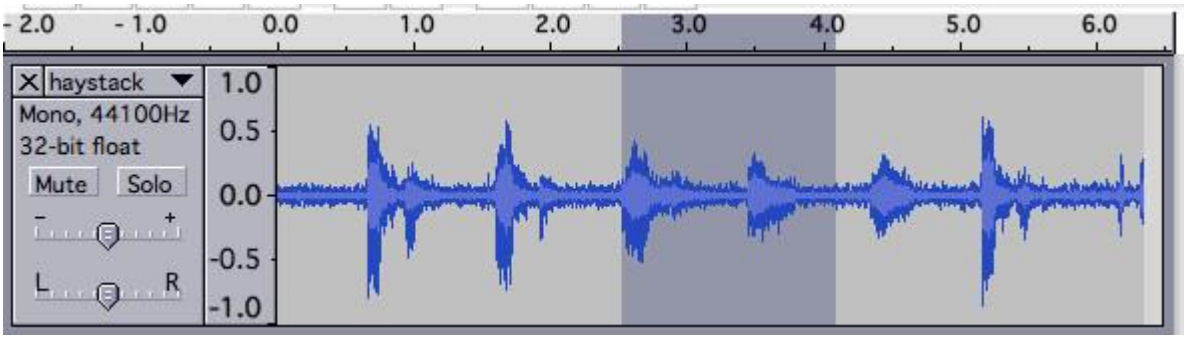
522253825433285668885771662040104167 = 891428822186035241·585861498344390287

Factoring an integer is a hard-computational problem (and the RSA cryptosystem depends on it being hard). At the core of the most sophisticated integer-factoring algorithms is a simple problem in linear algebra.

Image blurring

Blurring an image is a simple linear transformation.

Searching within an audio clip



Searching for one audio clip within another can be formulated as a convolution. A convolution can be computed very quickly using the Fast Fourier Transform.

Searching within an image

Convolution can also be done in two dimensions, enabling one to quickly search for a subimage within an image.

Audio and image compression

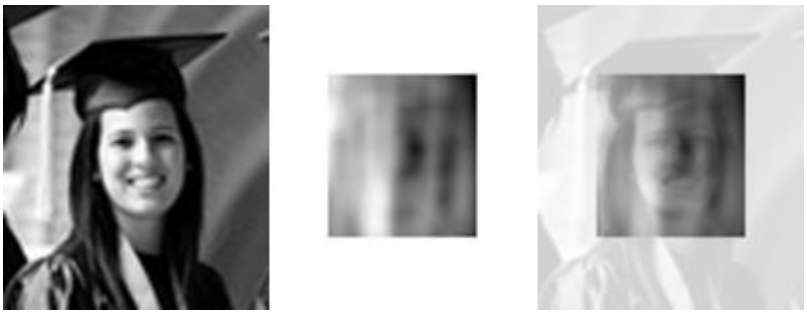
Compression of audio and images aids efficient storage and transmission. Lossy compression techniques such as those used in MP3 (audio) and JPEG (images) are based in part on linear algebra, e.g. wavelet transform and Fourier transform.

100% original size

40% original size

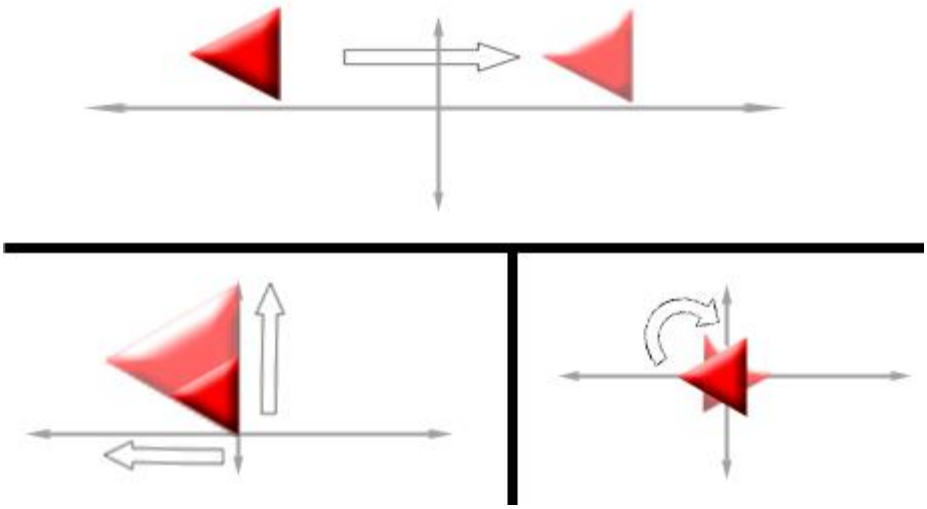
10% original size

Face detection



A "classical" approach to face detection is eigenfaces, a technique related to principal component analysis.

2d graphics transformations

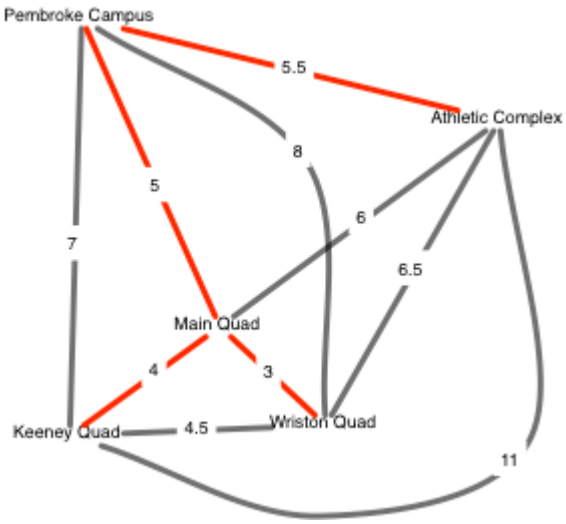


Simple transformations that arise in graphics such as rotation, translation, and scaling can be expressed using matrices.

Lights Out

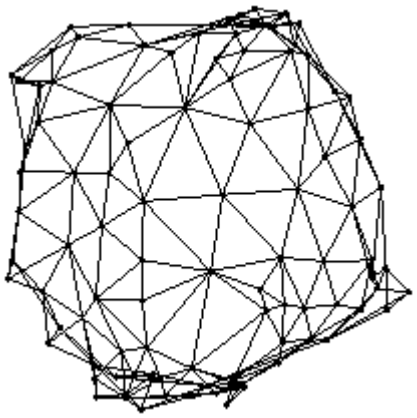
Lights Out is a puzzle in which you must select the correct buttons to push in order for all the lights to go out. Finding a solution can be expressed as a problem in linear algebra.

Minimum-weight spanning forest



Finding the minimum-weight spanning tree of a graph can be interpreted as the problem of finding a minimum-weight basis for a vector space
derived from the graph.

Graph layout



A nice drawing of a graph can be obtained from eigenvectors of a related matrix.