Gaussian Elimination pt. 2

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Gaussian Elimination Uses

Last week we studied Gaussian Elimination and its functionality.

This week, we are going to look at practical applications of this technique and how to approach problems using it.

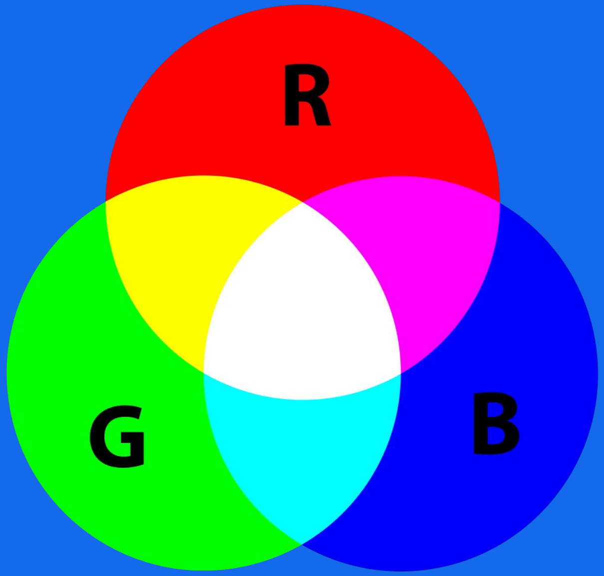
Image Compression☺️

Using data compression with
Gaussian Elimination

One representation of Images on computers is made up of **3 values**:
Red, Green, and Blue color data.

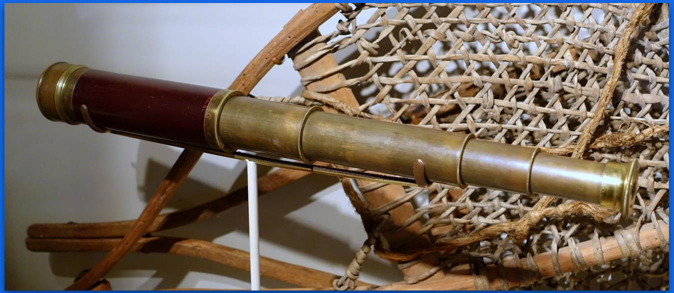
Each pixel has this data, which can make reading a large image's data and displaying it a monumental task.

The solution is compression! While there are a large number of ways to do image compression, we're going to be focusing on is compression often used for **videos**, aka multiple images back to back.



To simplify storage, we can save each image's Red, Green and Blue layers separately. However, this raises a problem; a lot of the image is repeated, meaning we are technically wasting storage.
(See example 5.5 in textbook)

This data is stored as linear equations (which, conveniently, can also be represented with matrices). Using these linear equations, we can see just how similar the RGB layers are to each other.



DEMO TIME

LI and LD

Concept	Definition
Linear Dependence	A set of vectors $\{\mathbf{v}_1, \mathbf{v}_2, \ldots, \mathbf{v}_n\}$ in a vector space is **linearly dependent** if there exist scalars $c_1, c_2, \ldots, c_n$, *not all zero*, such that the following vector equation holds: $$c_1\mathbf{v}_1 + c_2\mathbf{v}_2 + \cdots + c_n\mathbf{v}_n = \mathbf{0}$$ This signifies that at least one vector within the set can be expressed as a linear combination of the remaining vectors. This indicates redundancy among the vectors in the set.
Linear Independence	A set of vectors $\{\mathbf{v}_1, \mathbf{v}_2, \ldots, \mathbf{v}_n\}$ in a vector space is **linearly independent** if the *only* solution to the vector equation: $$c_1\mathbf{v}_1 + c_2\mathbf{v}_2 + \cdots + c_n\mathbf{v}_n = \mathbf{0}$$ is the trivial solution, where all scalars are identically zero: $$c_1 = c_2 = \cdots = c_n = 0$$ This implies that no vector in the set can be synthesized as a linear combination of the others. Each vector contributes distinct directional information not captured by the others in the set.

Reading Time/ Discussion

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

https://arxiv.org/pdf/0910.1362

Questions?

Let's do some practice!

https://images.pexels.com/photos/796603/pexels-photo-796603.jpeg?cs=srgb&dl=hand-desk-notebook-796603.jpg&fm=jpg

Next Week -

Reinforcement Learning

Goal: Write a script to perform Gaussian Elimination automatically when provided a system of linear equations.