[matrix]

WORLD OF MATRICES

AYUSH GUPTA

World of Matrices

--*Ayush Gupta (03-06-2025)*

One day I was studying linear algebra with 3Blue1Brown's YouTube channel, I noticed at my left that the clothes were hanging on the door and my fan was at full speed so the clothes were moving gently and coming back to their positions. I immediately thought of two worlds, one world where the cloth moved due to the physics and the other world was of Matrices-Vectors-Graphs. I imagined a world where everything was made up of matrices, vectors and their graphs so the clothes hanging was also a 3d graph of vectors that could be represented through matrices, and the discontinuous air from the fan was like every discreet packet of air represented by a matrix. When those small air matrices hit the surface of clothes then it would transform the graph of the clothes by multiplying their matrix by the cloth's graph so the clothes moves but the cloth is still a cloth even though it's been moved to other coordinates just like a vector remains the same vector in the graph transformations. This use of maths gives us a different view of the world.

If every physical objects and their movement could be classified at matrices and graph transformation then could our thoughts also be transformations to our personality? Whatever we have seen, heard, experienced has led to what we are now so it is indeed a our all experience has transformed that "personality vector", think of it like applying billions of small matrices to a graph transformation.

After some further research I got to know that the way I am mapping the world in matrices is exactly how transformations in graphics, robotics, and physics engines are modelled. For example, wind in simulations can be modelled as a force field applied through transformation matrices.

The way I tried to map the world with matrices-vectors-graph interaction now is something very similar that I was trying to do some months ago, I was trying to explain and model causality with geometric structure and my own mathematical tool called "dynamic sets" (due mathematical immaturity, I still haven't been able to define this tool in mathematical rigor, I just have an idea what this tool can do). This thought paper will be a soft-launch to my concept of "Geometric framework of Causality".

Dynamic Sets

The concept of Dynamic Sets is still in progress. In this approach, each particle or entity in the universe begins as a disjoint set. Upon interaction, these sets can temporarily share common elements and influence one another before possibly becoming disjoint again. Here's an oversimplified example to explain Dynamic Sets: Suppose a woman with work-related tension forgets to fill her engine oil and leaves for her office in a hurry. Her car stops due to engine failure at a turn, causing a traffic jam. Meanwhile, John, driving home, is forced to take a different route because of the traffic. Initially, John and the woman are disjoint sets, but her actions (engine failure) temporarily introduce a common element (traffic jam) into John's set, influencing his route. After the incident, they may become disjoint sets again "if their paths

never cross". This example illustrates how Dynamic Sets interact and influence each other before potentially becoming disjoint again.

The Delaunay Triangulation

Instead of directly jumping to the Delaunay triangulations, I will first have to jump into an analogy for the sake of understanding things more easily – In cloth simulations, the computer doesn't perceive the cloth as a soft, flowing object rather it represents the cloth as a network of points – vertices whose deformations are computed when forces act on them.
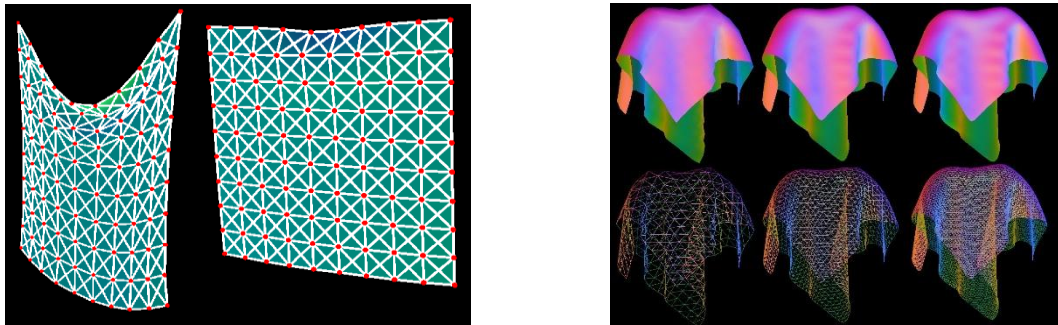

Images to show how a cloth is broken into vertices by computer for cloth simulations
Images from https://graphics.stanford.edu/~mdfisher/cloth.html

The cloth is never truly seen, only its structure and how that structure changes. Similarly, my framework models causality not by tracking physical events directly, but by capturing how underlying geometric structures transform over time, in one line **"events are not the focus rather how the events reshape the web beneath them."**

So, let's now come to the real deal of Delaunay Triangulations, this is the Delaunay Triangulations -
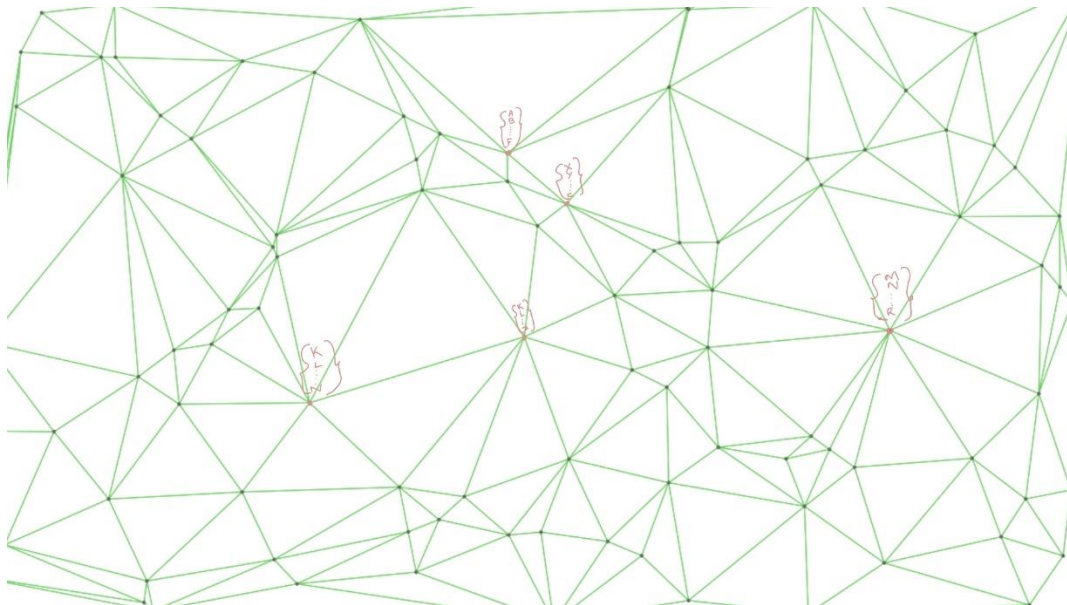
At every point where a line is intersecting is called node, and at the node there is a **Dynamic Set** which shows the relationship between a node and the nearby nodes (those letters written inside the set is just for simplification of representation, actually there would be real numbers in place of those letters).Every node

here represents a object, so what happens here is that "every action of those objects" or "every action done by the nearby nodes on that object" causes a geometric shift that changes the whole grid, so that action would affect the other nodes too. Well for now I am still working on this concept so this is just the basic idea of how would a "Geometric framework of Causality" might look like.

Here is a link to see Delaunay Triangulations in interactive 3D-

https://mikolalysenko.github.io/delaunay-triangulate/3d.html