Image formation

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EPFL Center for Imaging

2024-10-15

Into the 3D world

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Why 3D? Everything is 3D!

Let's start from our own perception

Question

Do we see depth, or just a flat image?

Let's start from our own perception

Question

Do we see depth, or just a flat image?
What about with only one eye?

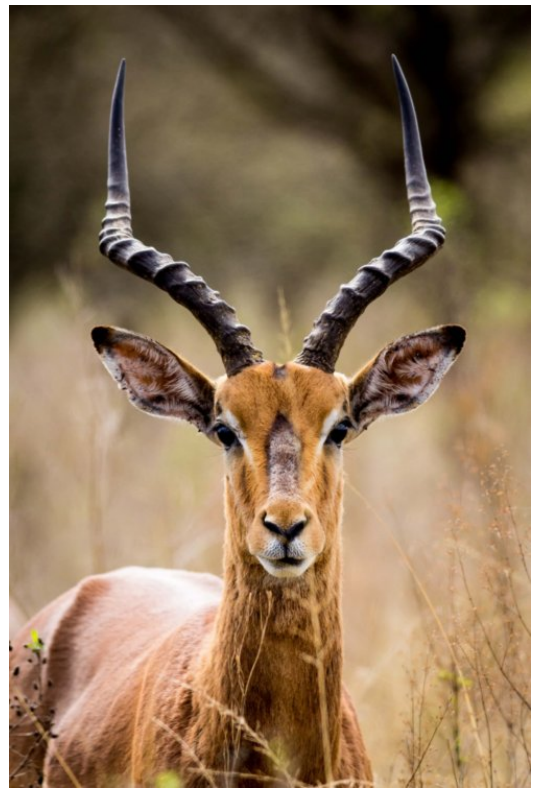
In the natural world

Who has better depth perception?

Tiger

https://www.tierart.de/wissenswertes-ueber-tiere/ueber-tiger-panthera-tigris

Antelope



https://unsplash.com/@sickpanda

Stereovision in 1 slide

Camera records pixels (x,y)...

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Camera records pixels (x,y)... but is looking at angles (θ, ϕ)

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– space for drawing –

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Underlying principle: multi-camera geometry

Completely different approach

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https://www.treehugger.com/bat-facts-4864066

TOF in one slide

Time-of-flight method: underlying principle timing a reflected wave

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SL in one slide

Structured light: projecting a known pattern and looking at its deformation

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Structured light: projecting a known pattern and looking at its deformation

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Underlying principle: single-camera geometry and tracking

Two (+1) main families of methods

These will each be presented by a PhD student (Bryan and Andrea).

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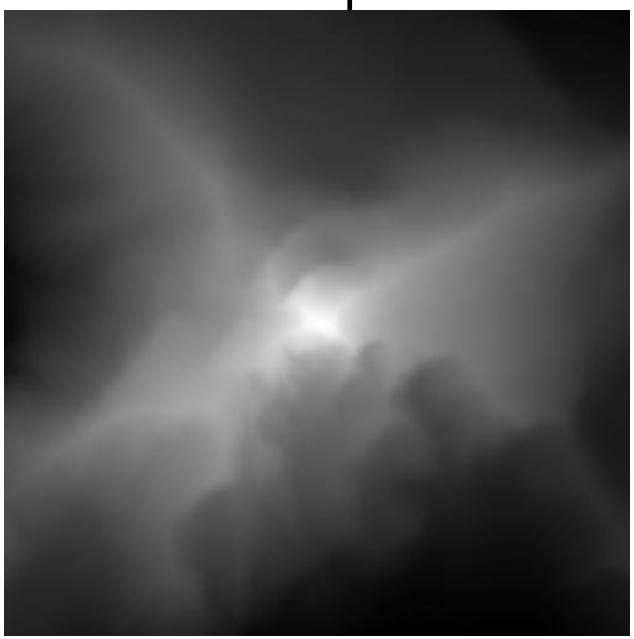
Before we start, some key ideas:

- What the data will look like
- Possible analysis and interpretation
- Some basic ideas to structure your thoughts

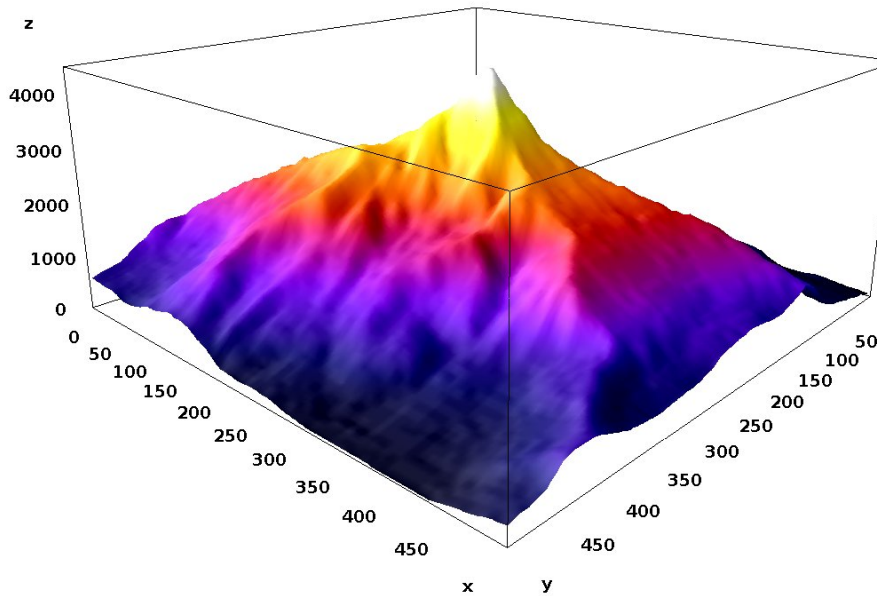
We've already seen this:

Pixelised Digital Height Map



$\Rightarrow$

3D rendering



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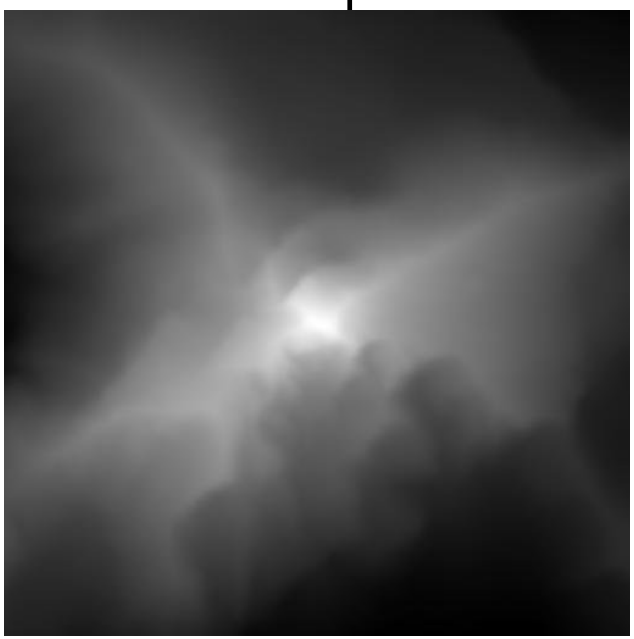

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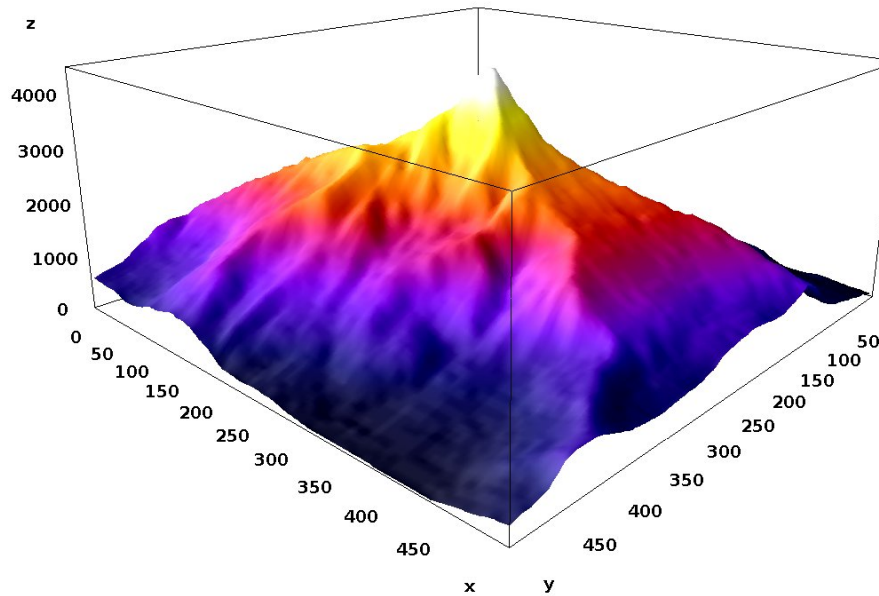

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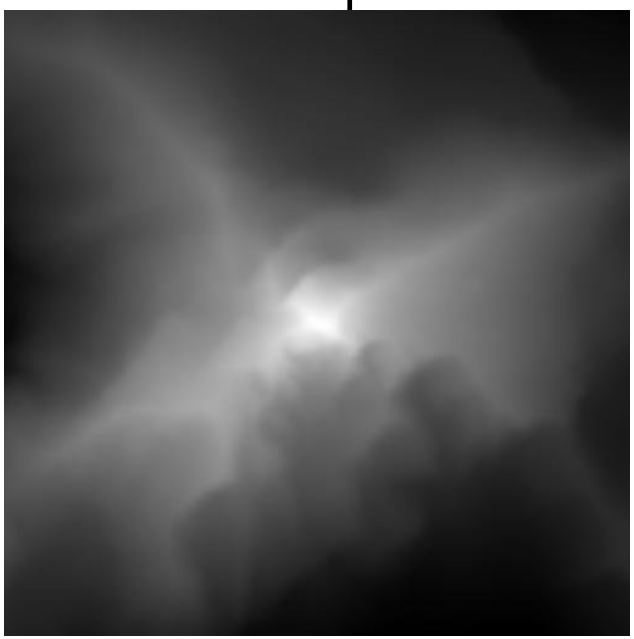

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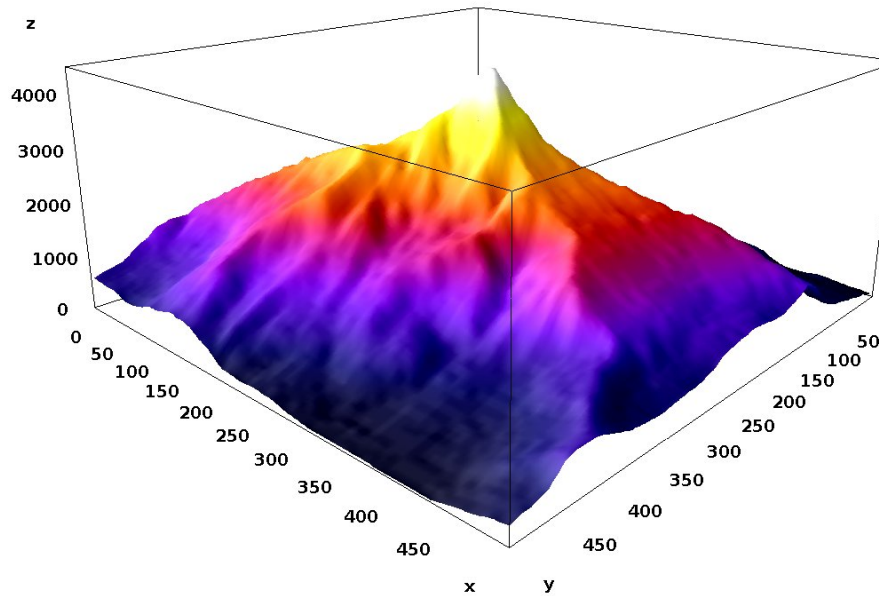

This is a matrix $H(x, y)$ right? This digital height map is a possible way of showing depth from a single view

Raw data in 3D

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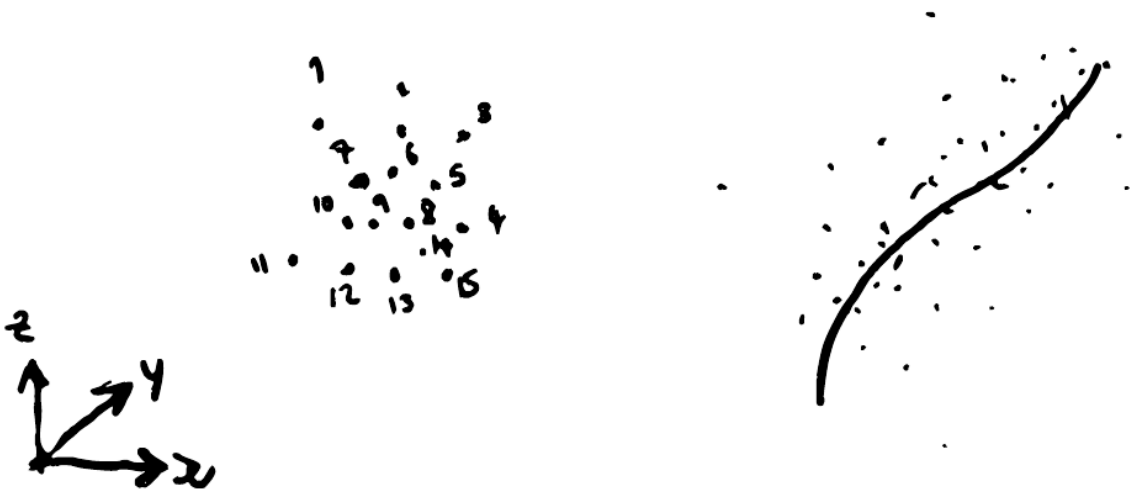

What does it look like inside the computer?

3D surface data

Surfaces are defined with a plane, which is typically discretised – meshed – into triangles

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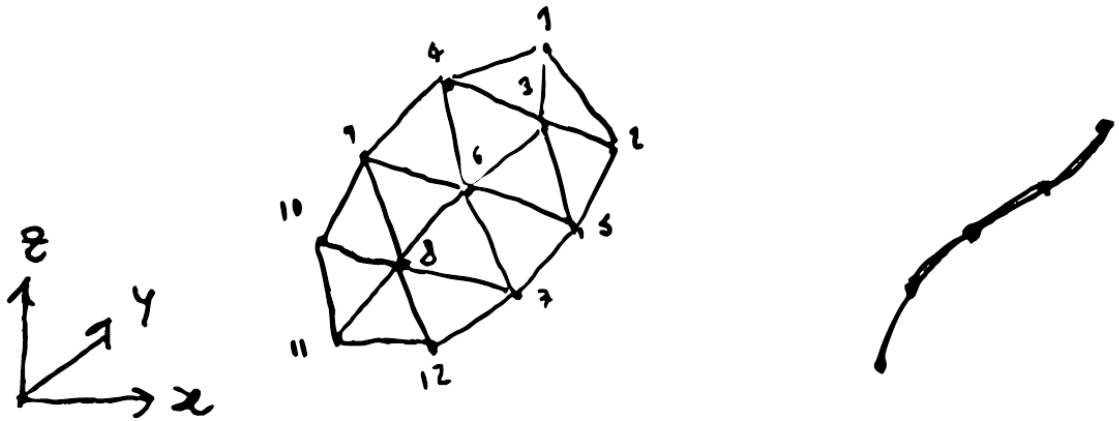

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