



Talent
Land®

Workshop 2



***“¿Cómo
funciona la
Realidad
Aumentada?”***

DR. RUBÉN
ALVAREZ
TALENT LAND
2024



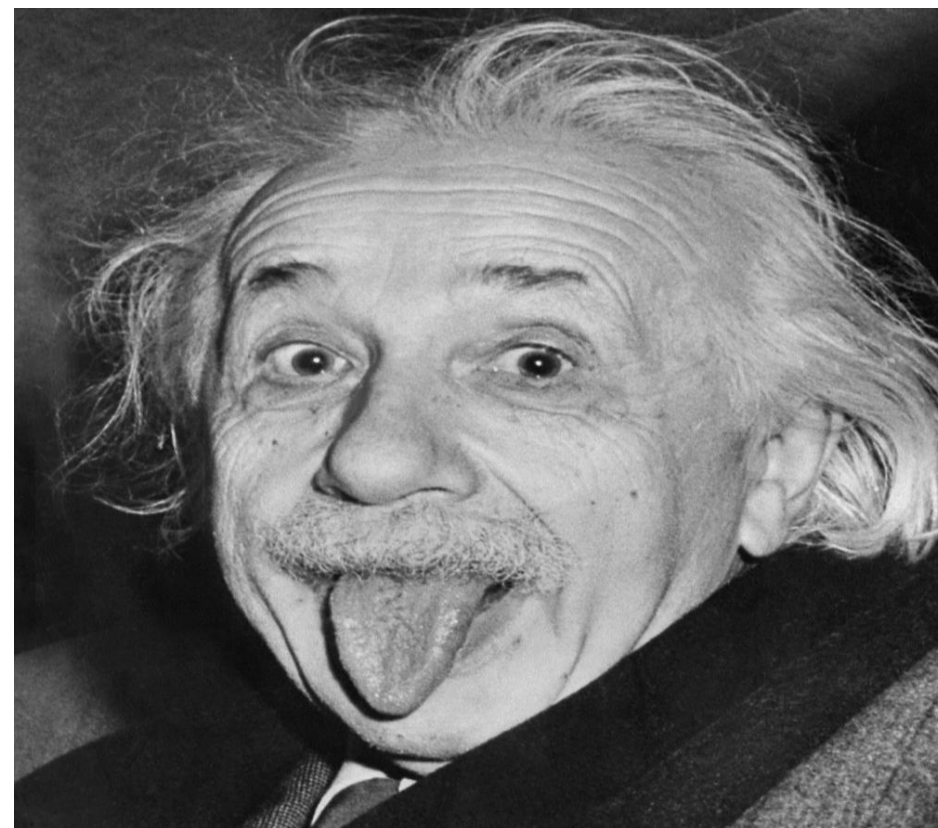
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https://github.com/bioruben/talent_land_2024_cv



- *"Everything human beings can imagine; nature has already created..."*
- -Albert Einstein.



WHAT IS COMPUTER VISION?



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- Humans use our eyes and our brains to see and visually perceive the world around us. Computer Vision is the science that aims to provide a similar, if not better, capability to a machine or computer.



COMPUTER VISION



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1. Optics and 3D Reconstruction
2. Image Processing
3. Machine Learning in images

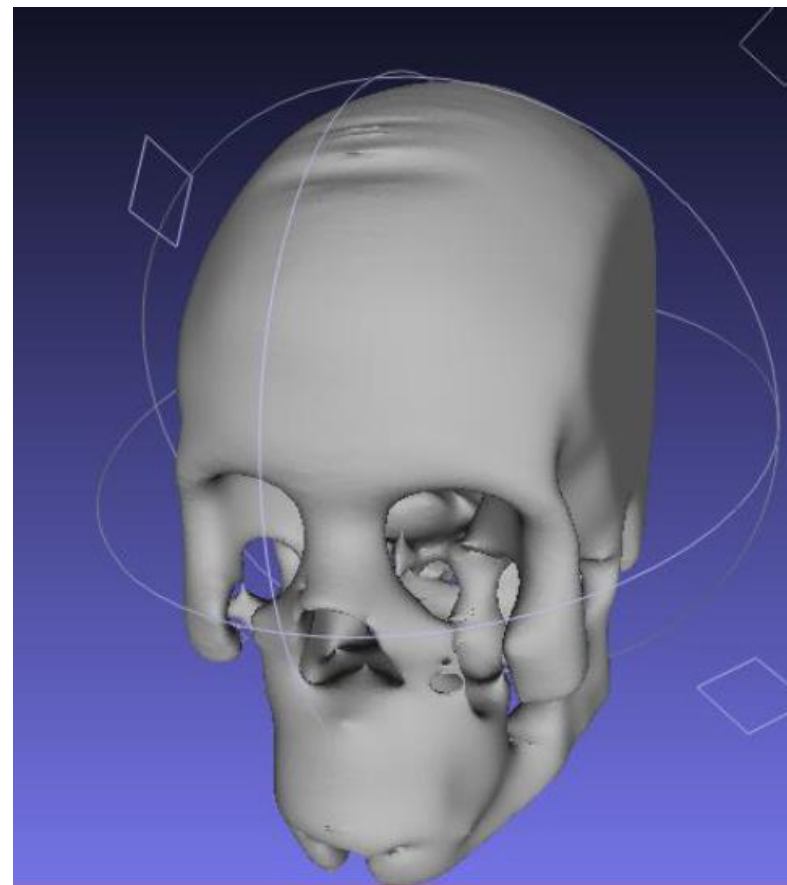
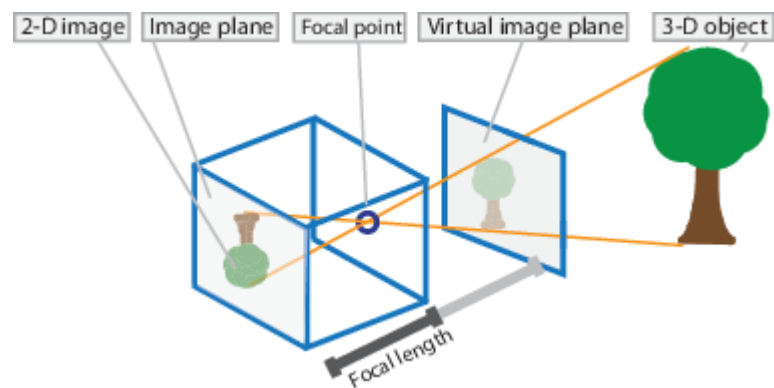


1. **Optics and 3D Reconstruction**
2. Image Processing
3. Machine Learning in images

OPTICS AND 3D RECONSTRUCTION

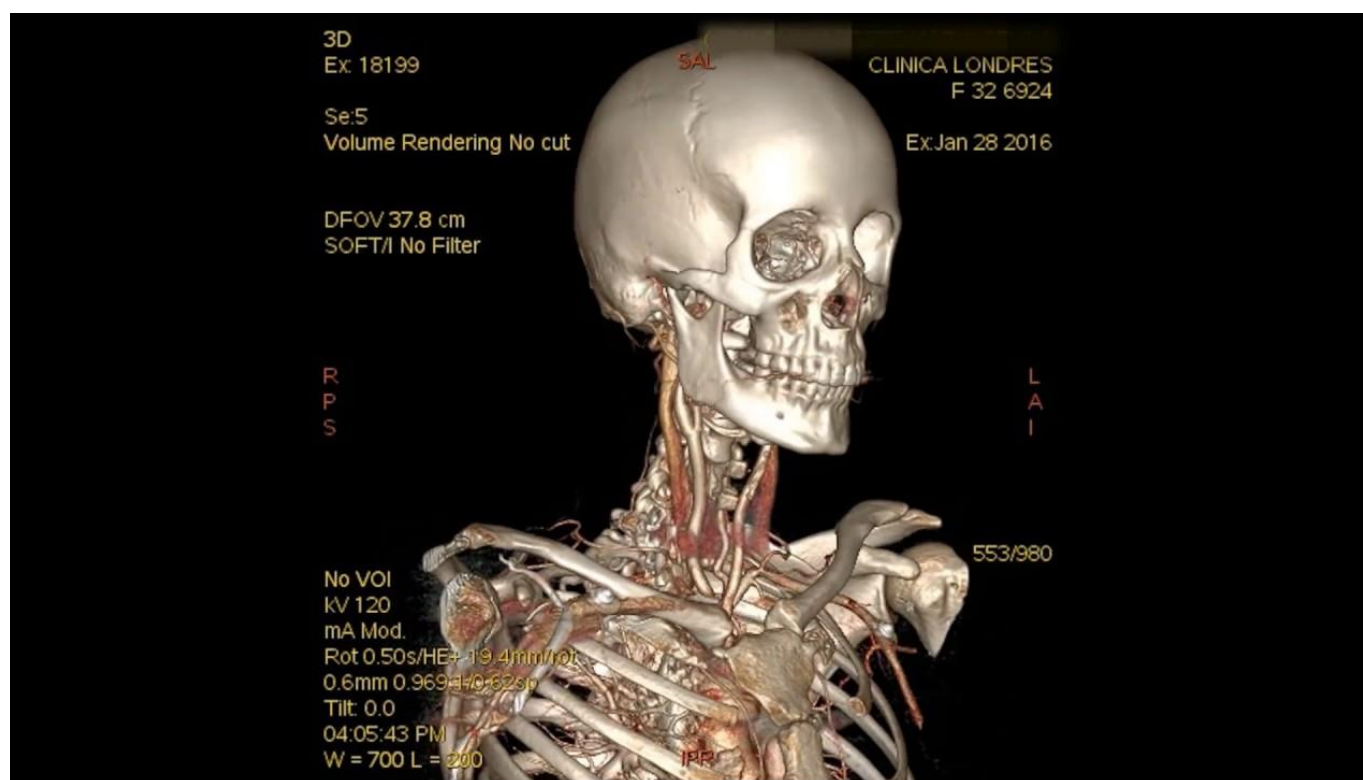


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1. Optics and 3D Reconstruction
- 2. Image Processing**
3. Machine Learning in images

IMAGE PROCESSING



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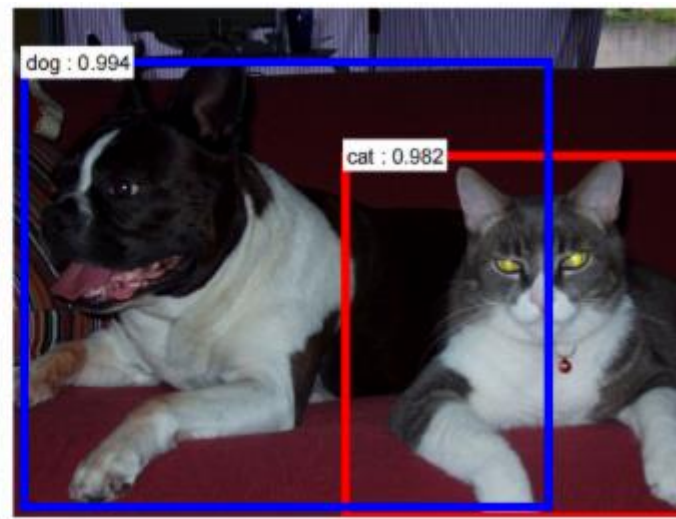
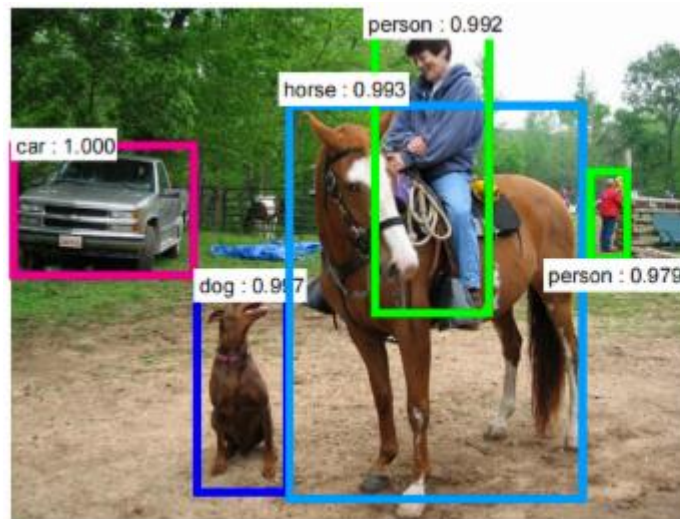
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1. Optics and 3D Reconstruction
2. Image Processing
3. **Machine Learning in images**

OBJECT RECOGNITION



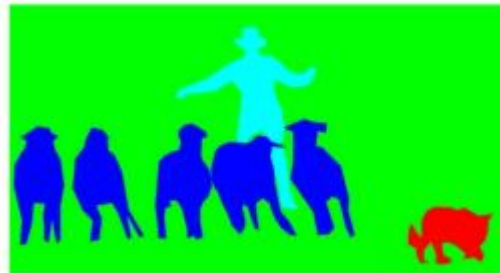
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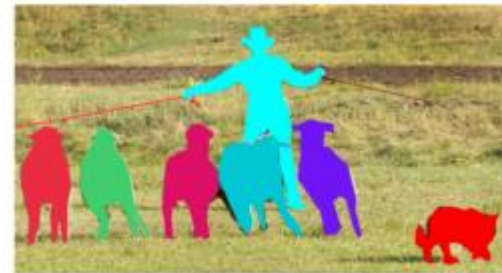
SEGMENTATION



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(c) Semantic segmentation



(d) Instance segmentation

STYLE TRANSFER



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Input image



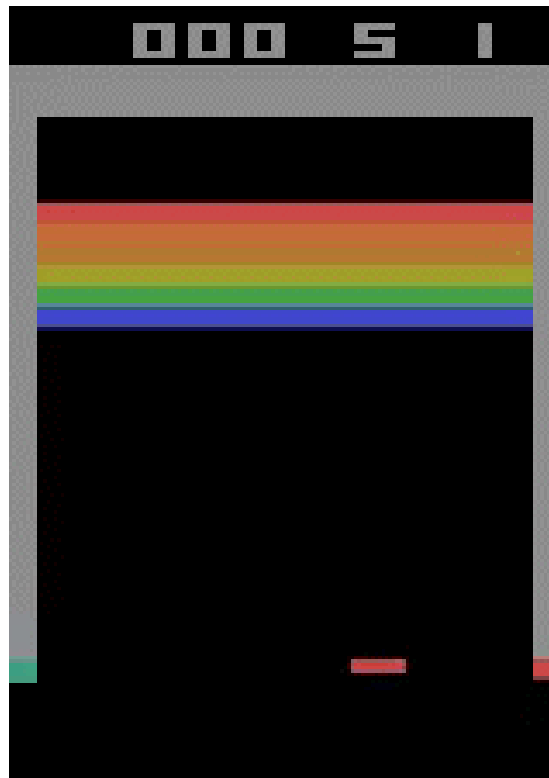
GFPGAN output



VIDEO GAMES



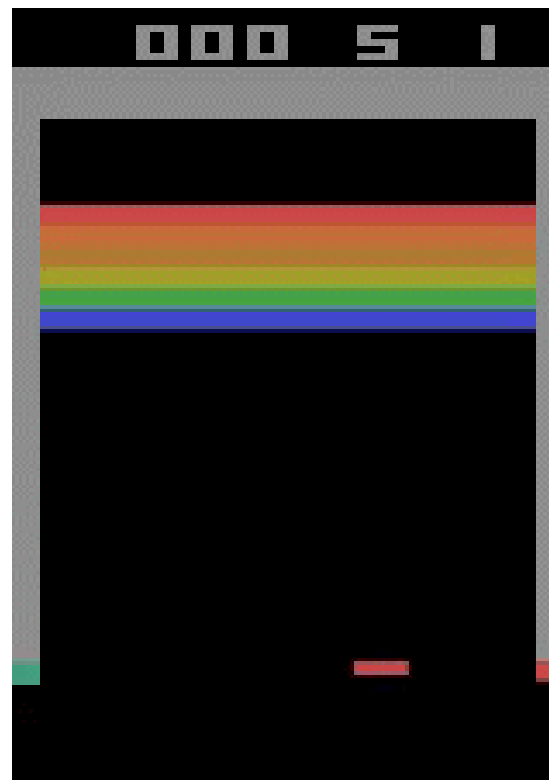
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VIDEO GAMES



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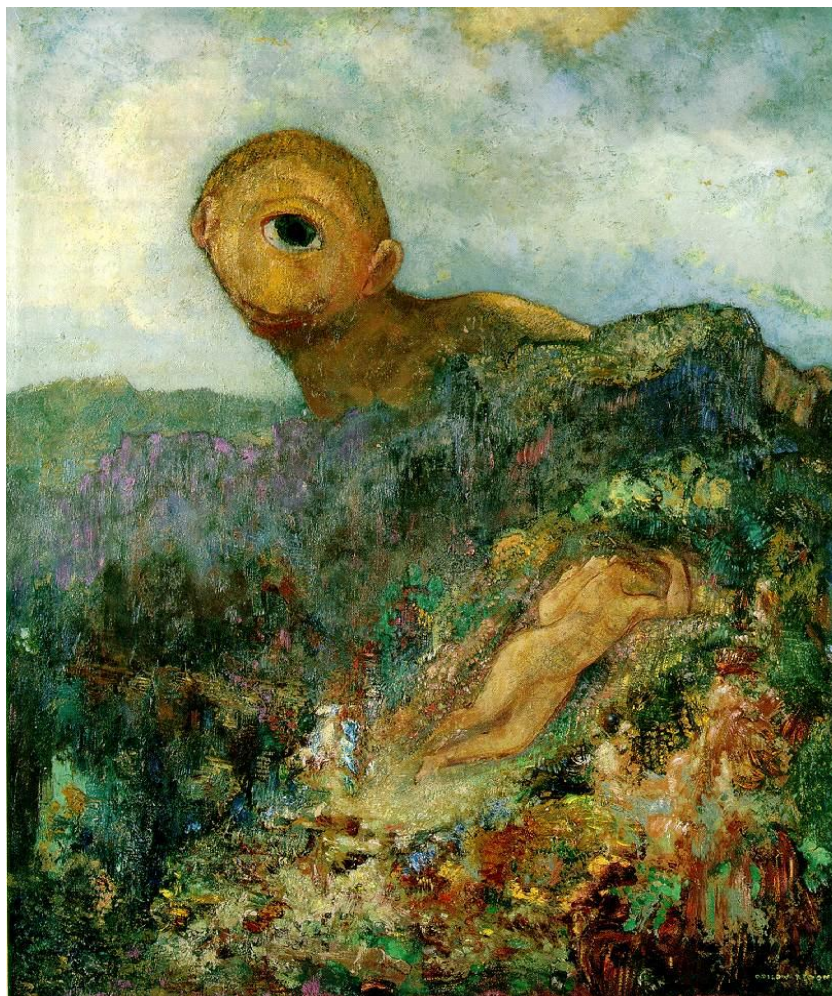
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PERCEPCIÓN 3D

SINGLE-VIEW GEOMETRY



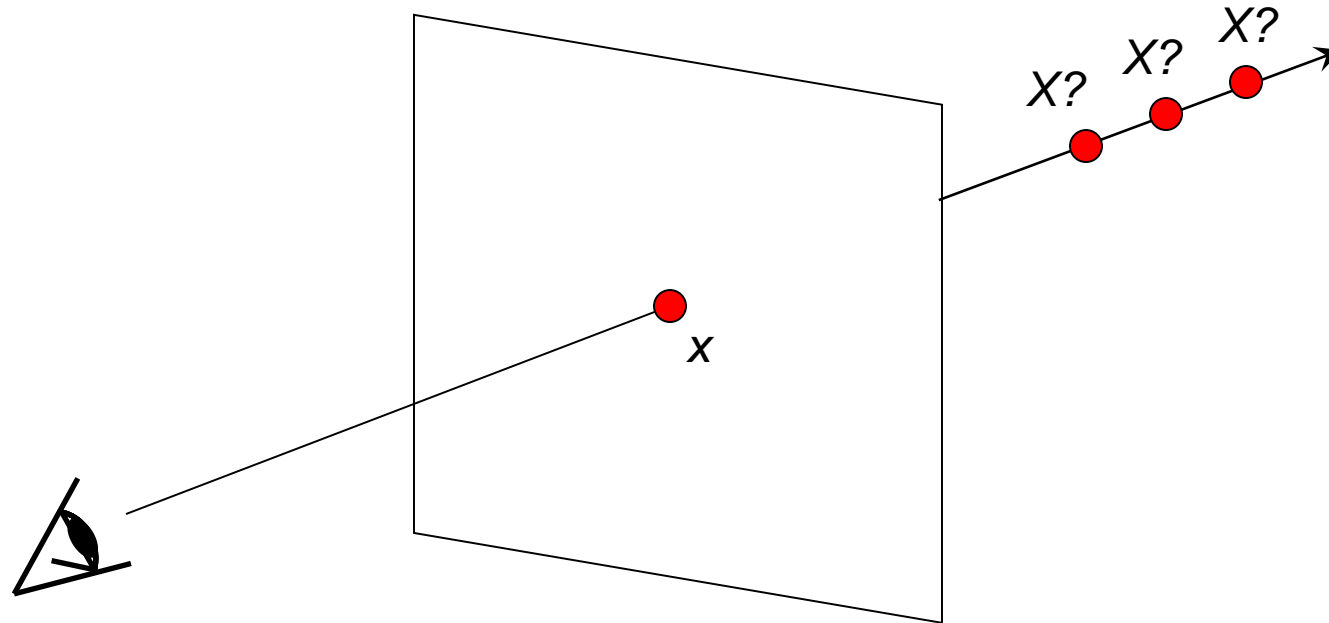
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Odilon Redon, *Cyclops*, 1914

OUR GOAL: RECOVERY OF 3D STRUCTURE

- Is recovering the structure of an image unambiguous?



OUR GOAL: RECOVERY OF 3D STRUCTURE



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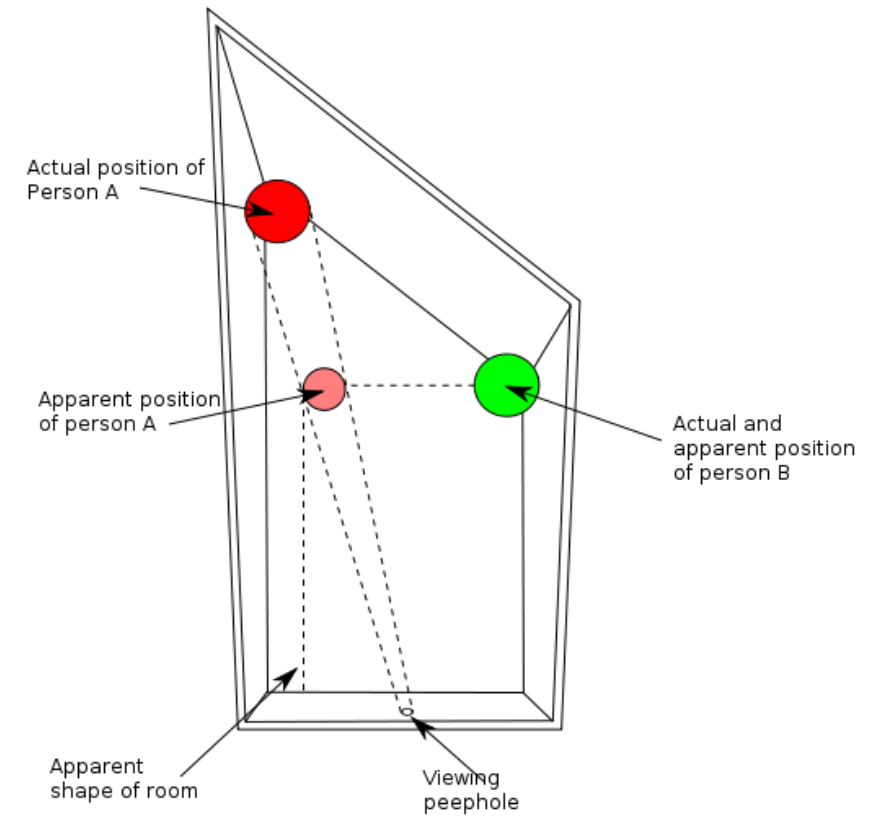
- What about perspective?



AMES ROOM



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AMES ROOM



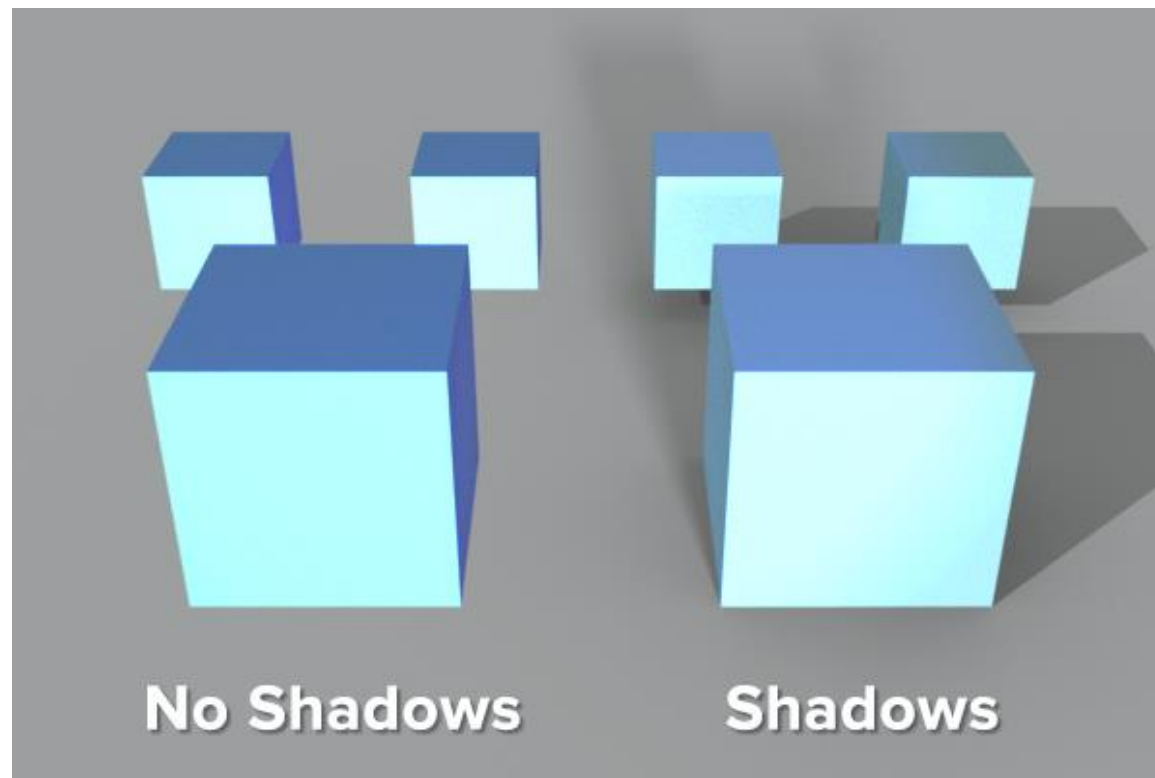
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VIRTUAL REALITY LIGHTING



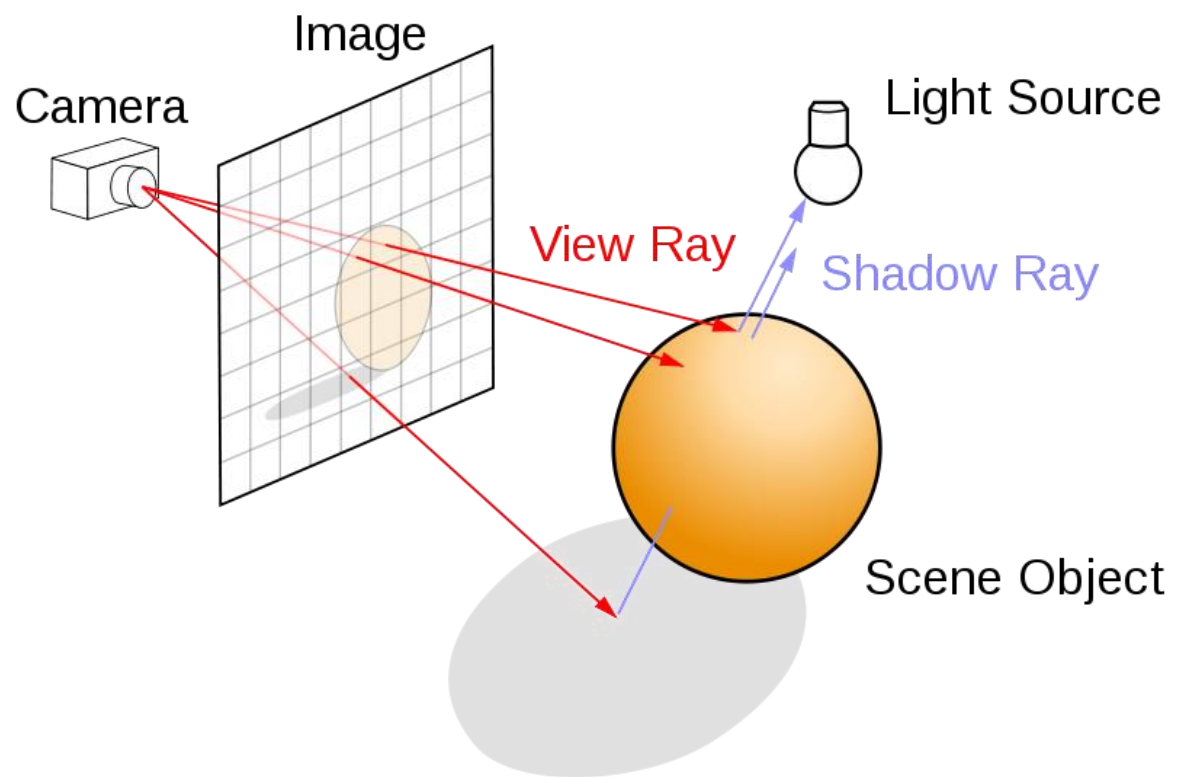
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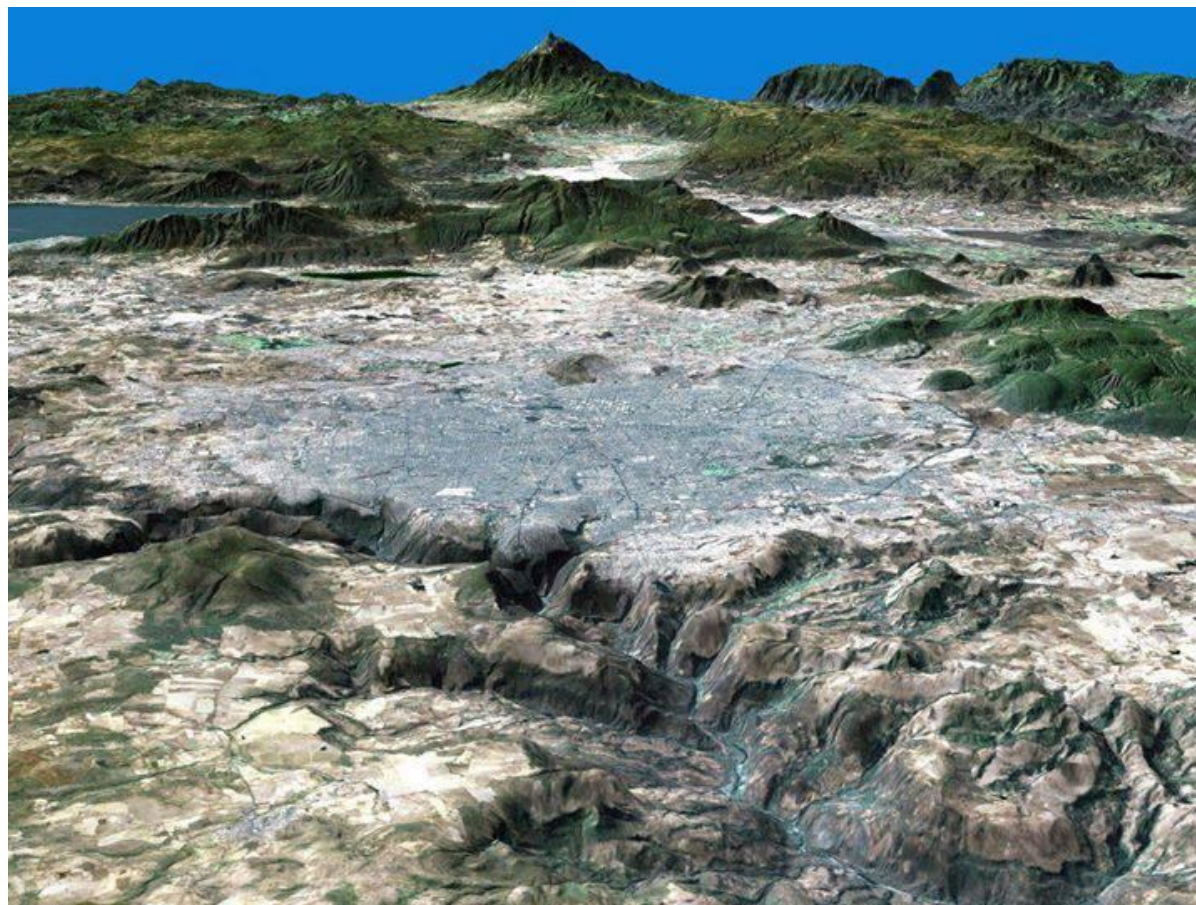


RAY TRACING



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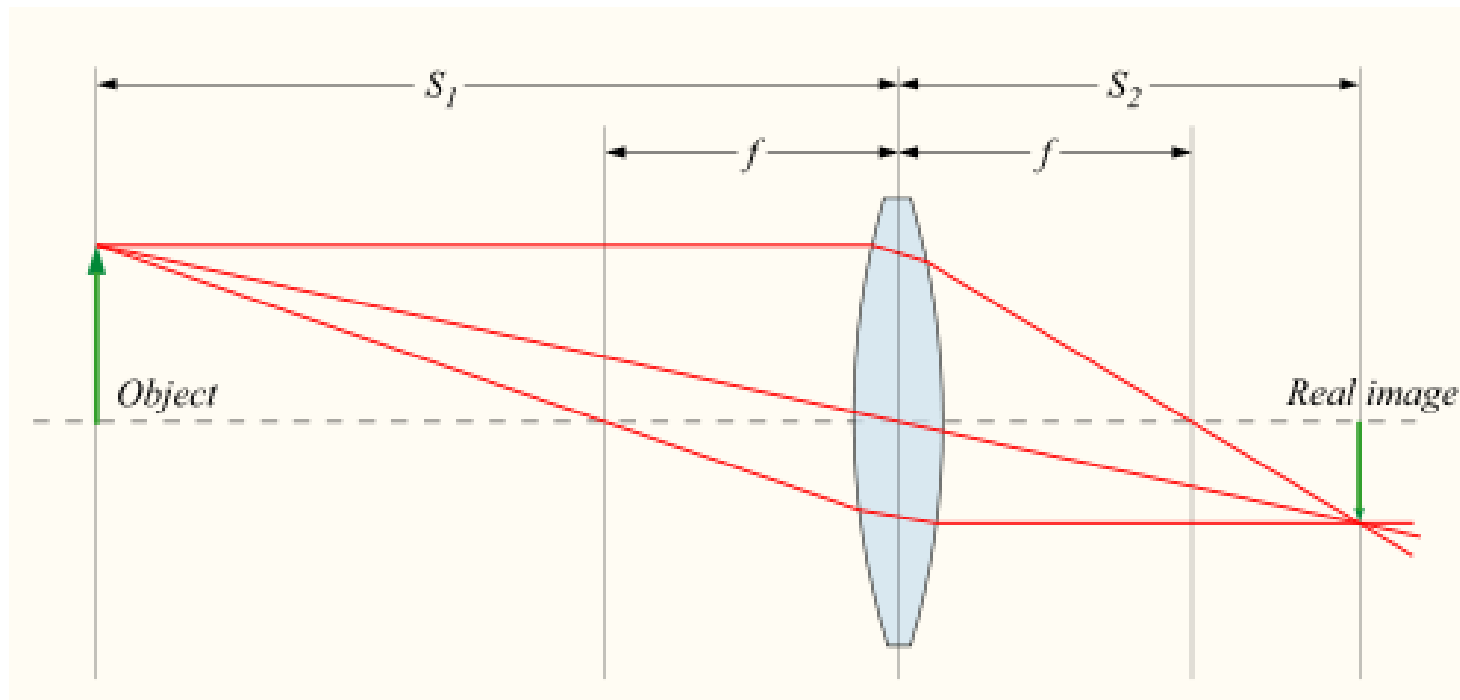


THIN LENSES



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- Gaussian Law $\frac{1}{z} + \frac{1}{z} = \frac{1}{f}$



CAMERA CALIBRATION



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$$\blacksquare \begin{pmatrix} p_{xi} \\ p_{yi} \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{f}{dx} & -\rho \frac{f}{dy} & c_{xi} \\ 0 & \frac{f}{dy} & c_{yi} \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} X_w \\ Y_w \\ Z_w \end{pmatrix}$$

COMPUTER VISION

¿CUÁL ES LA DIFERENCIA ENTRE RV Y RA?



¿CUÁL ES LA DIFERENCIA ENTRE LA REALIDAD AUMENTADA (RA) Y LA REALIDAD VIRTUAL (VR)?

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VIRTUAL REALITY



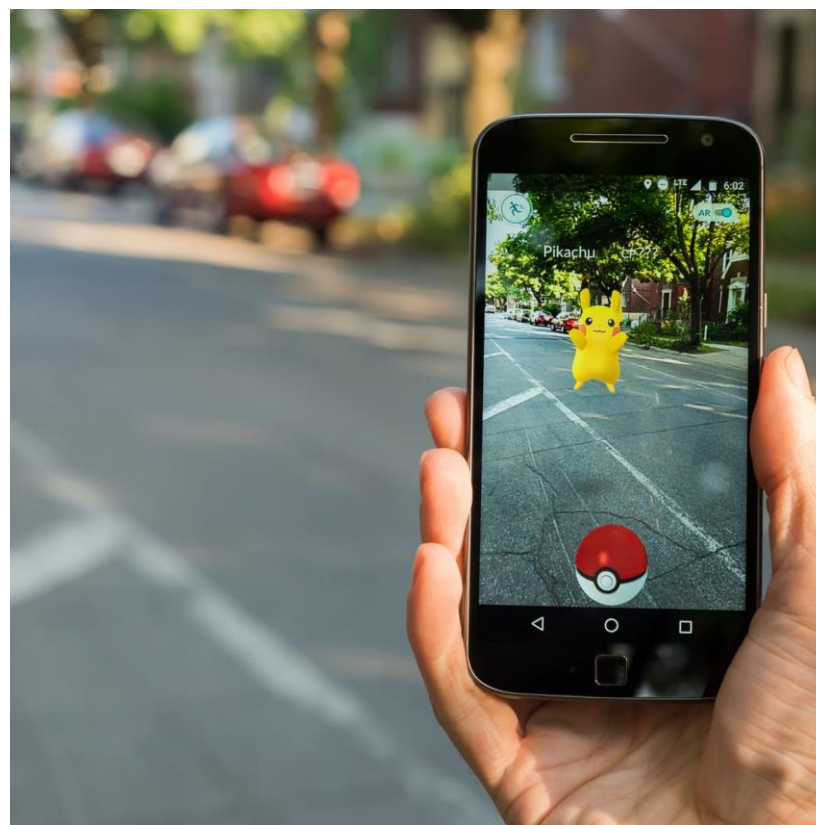
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AUGMENTED REALITY



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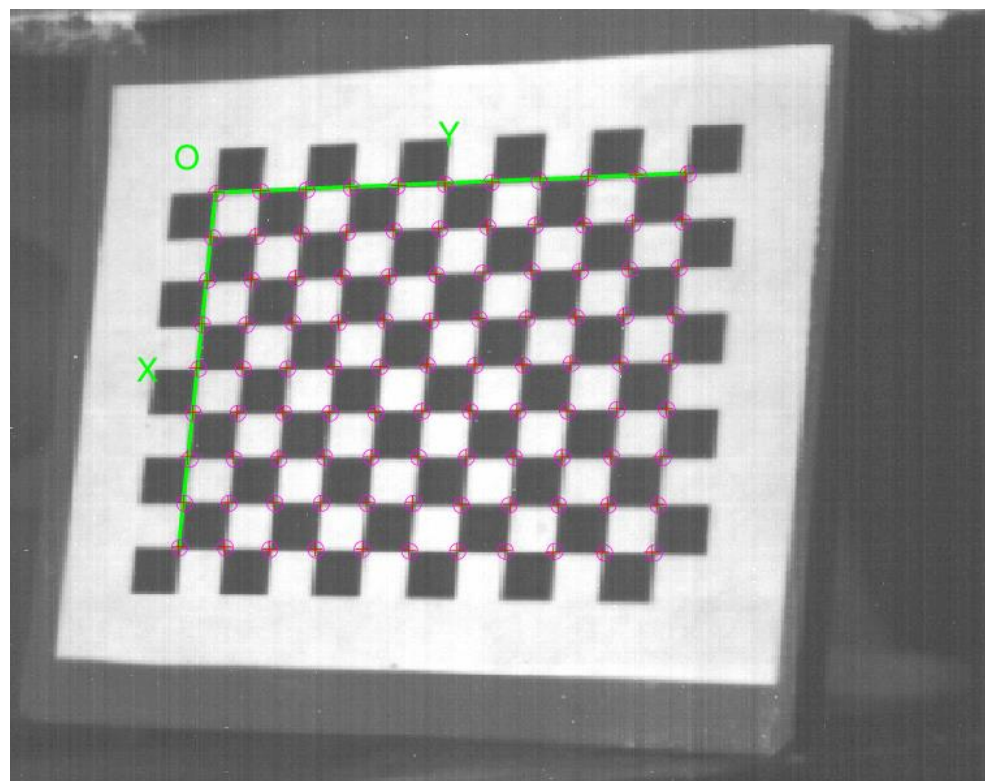
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DEMO ARUCO

CHECKERBOARD



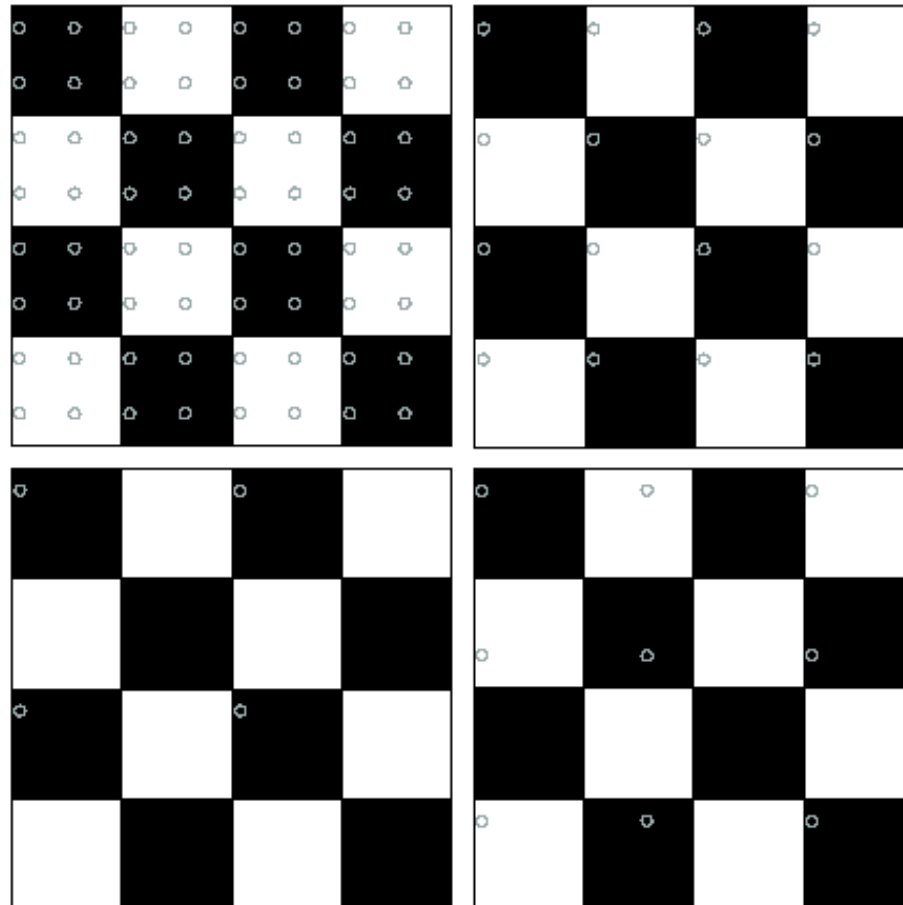
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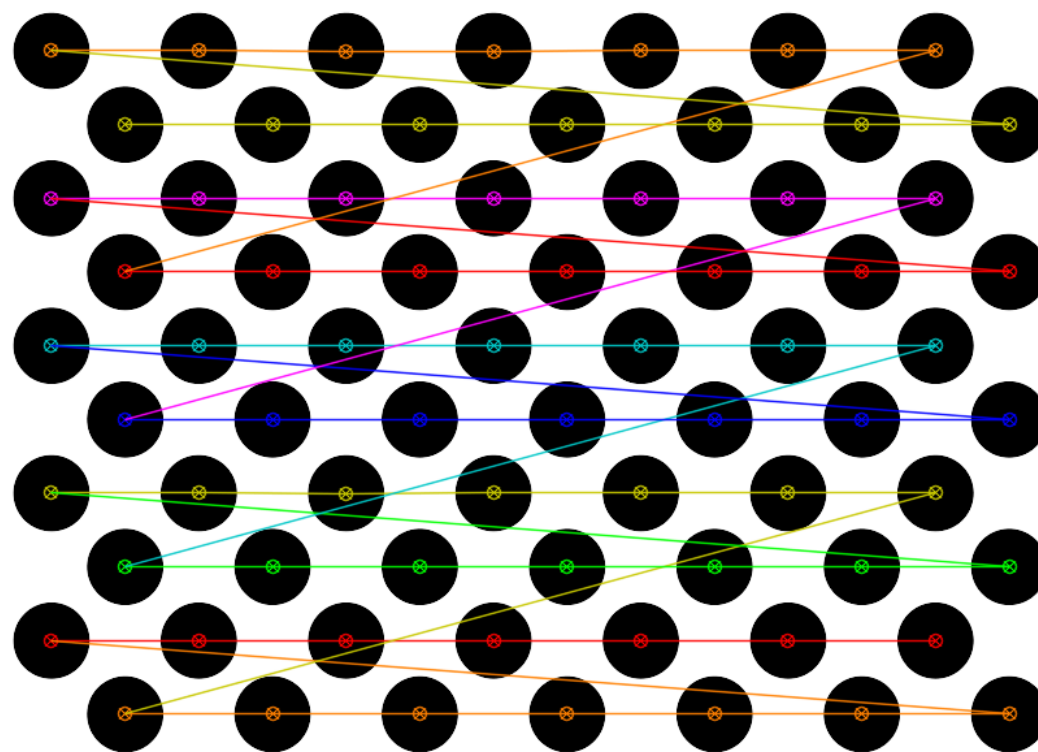


CHECKERBOARD



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COMPUTER VISION

3D CLOUD SAMPLES

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DEMO MARKERS 4 VOLUNTARIOS

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¿QUÉ POKÉMON DE LOS INICIALES USTEDES
PREFERÍAN?



**“Those who can
imagine
anything, can
create the
impossible.”**

-Alan Turing



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Questions?

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