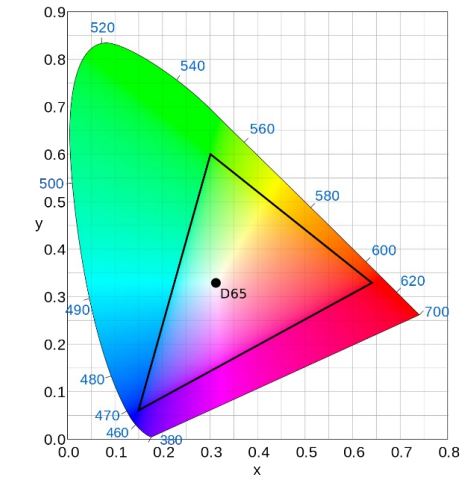
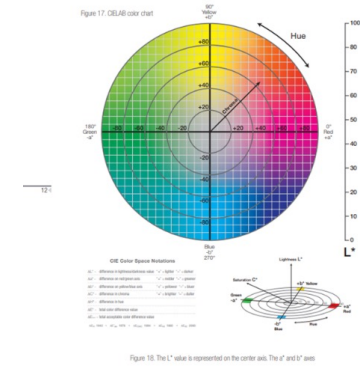
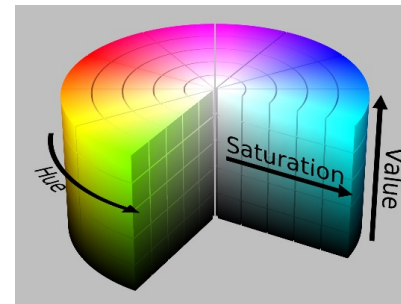
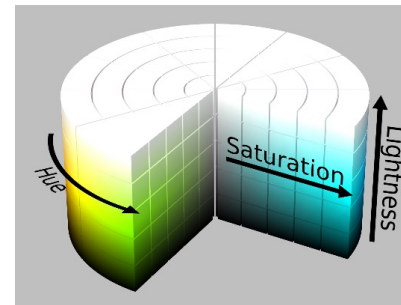
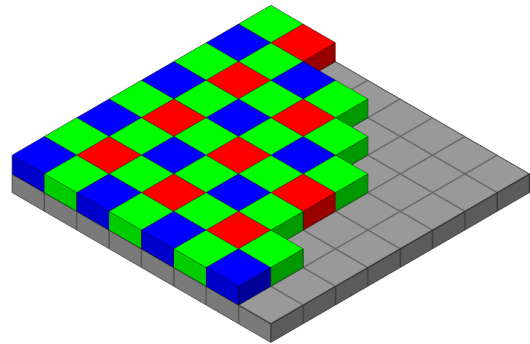
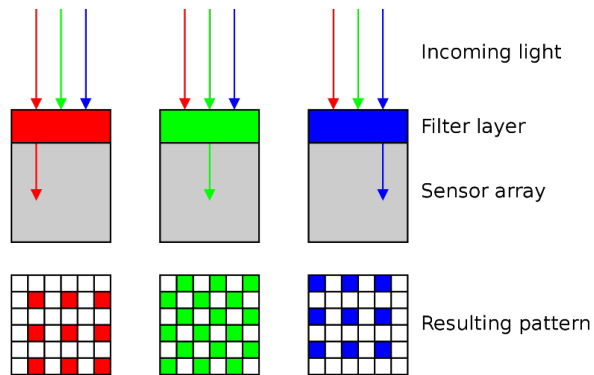


3D Graphics and Computer Vision

- António Ramires Fernandes (arf@di.uminho.pt)
- Luís Paulo Santos (psantos@di.uminho.pt)

Image Acquisition and color Spaces



Fourier Transform

Fourier Transform

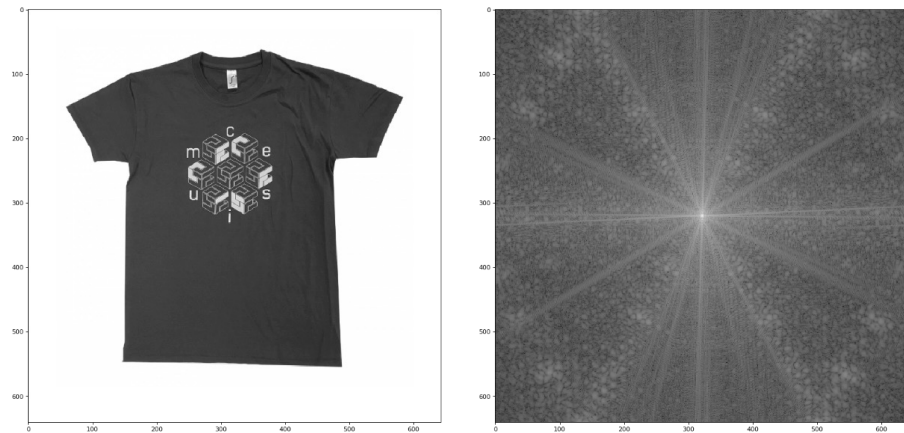
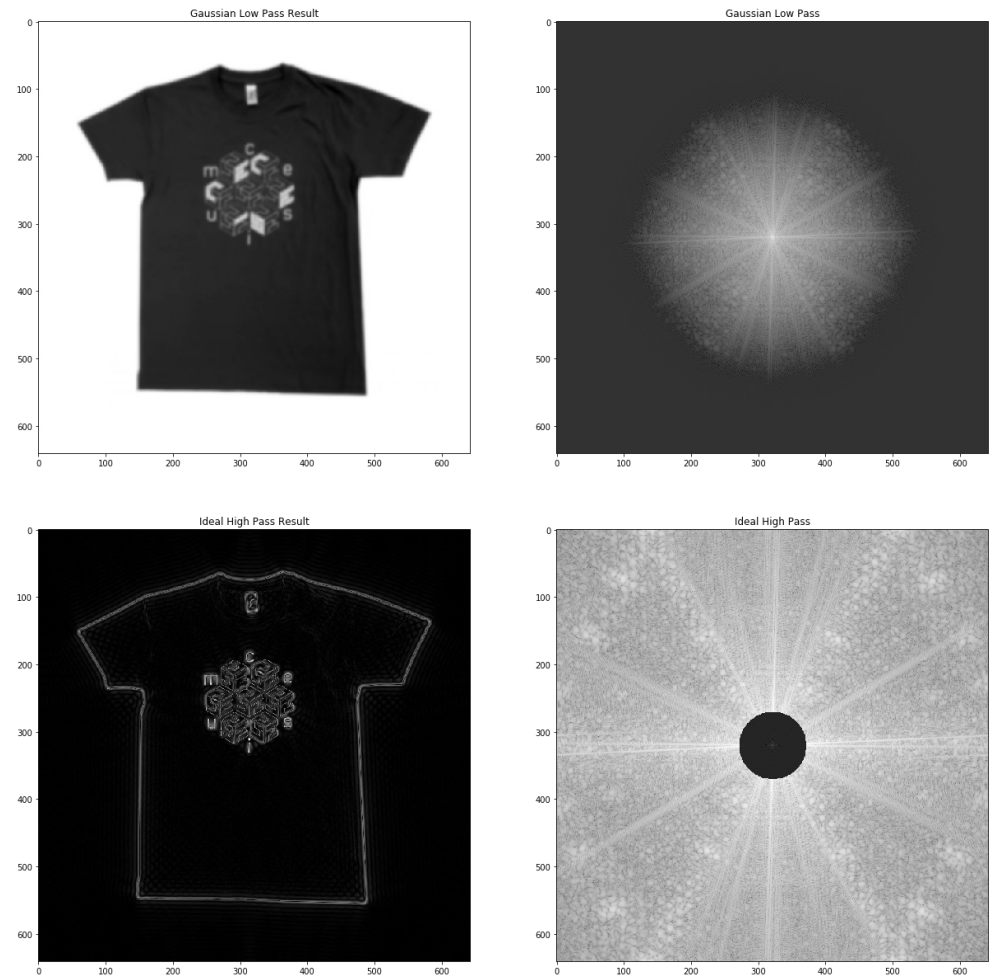


Image Processing with Fourier Transform

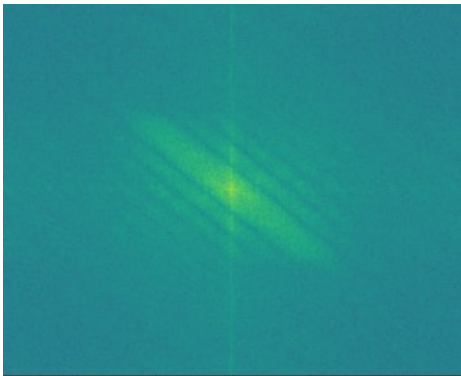


Filtering and Image Features

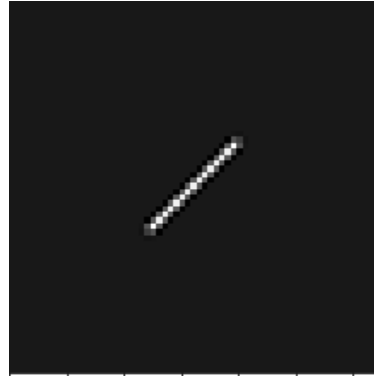
Deconvolution



Fourier Transform



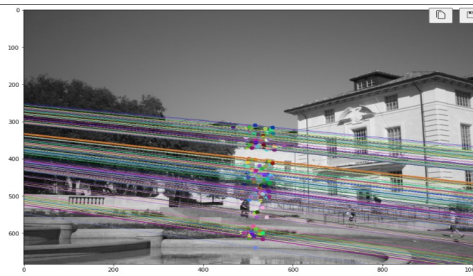
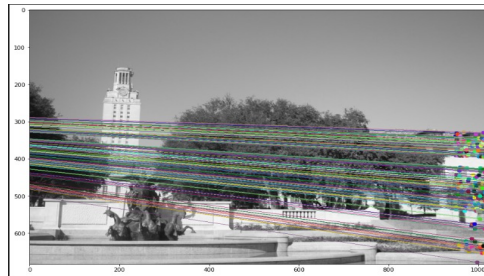
Point Spread Function



SIFT Feature Detection



Scene Geometry



Computer Vision with Deep Learning

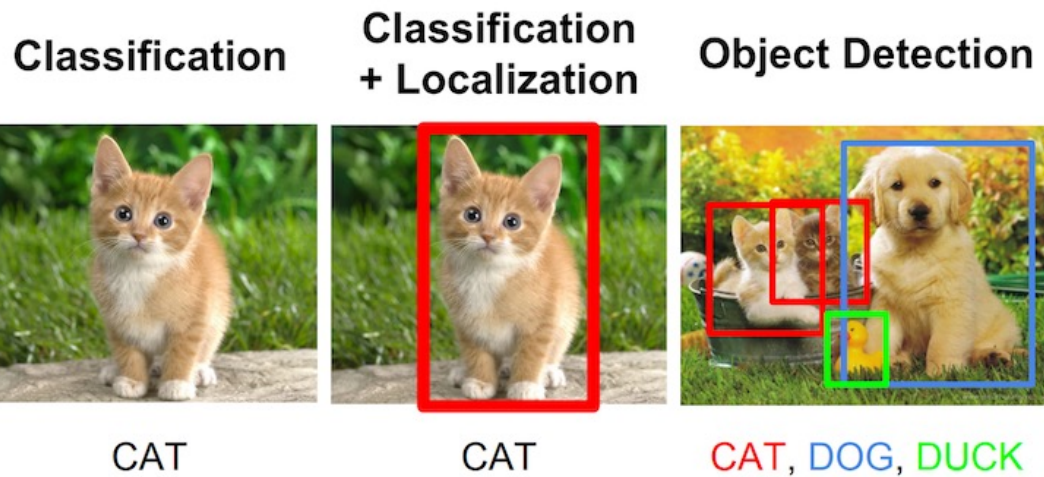


Image from: *Stanford Convolutional Neural Networks for Visual Recognition Course*
<http://cs231n.stanford.edu/>

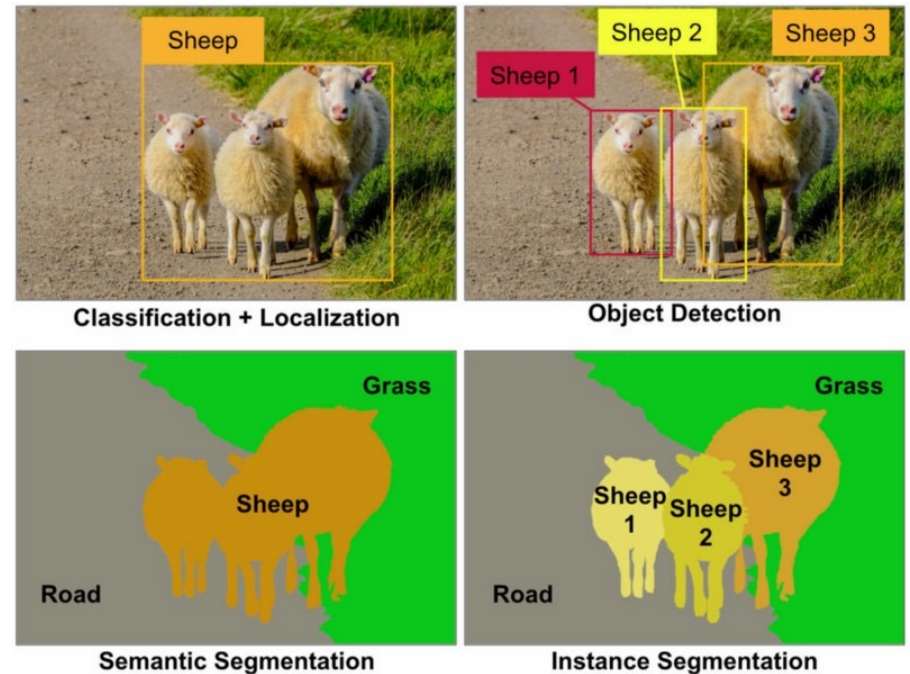


Image from: *Detection and Segmentation through ConvNets, Towards Data Science*
<https://towardsdatascience.com/detection-and-segmentation-through-convnets-47aa42de27ea>

Deep Learning – Issues

Adversarial Examples

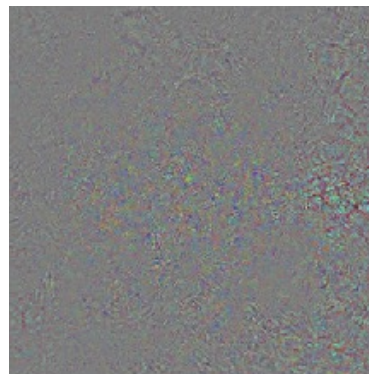
lynx 55.9%



+

noise

max % 0.043



=

cauliflower 99.5%



The right image looks as a cat to a person, but gets misclassified with high confidence by the NN

Deep Learning Visualization

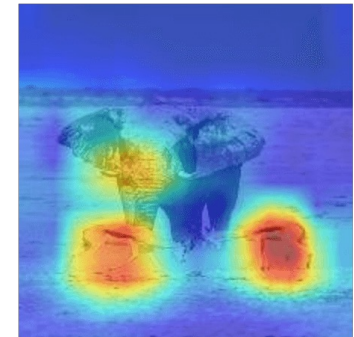
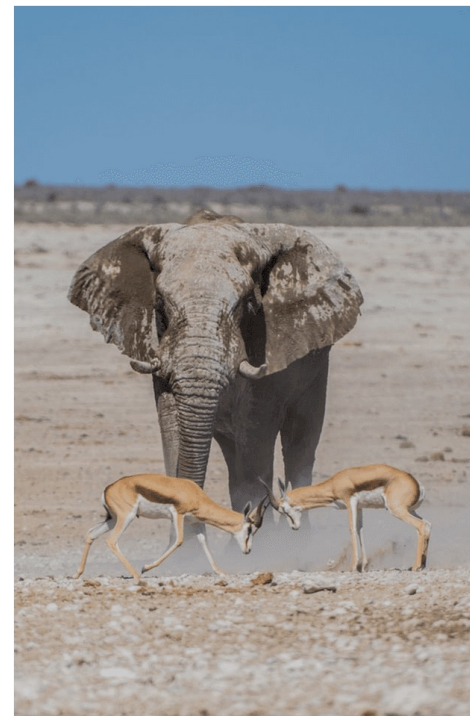
Deep Dream



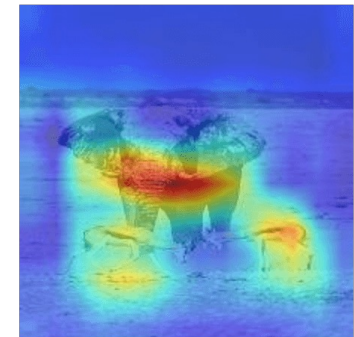
Style Transfer



Model Visualization



gazelle

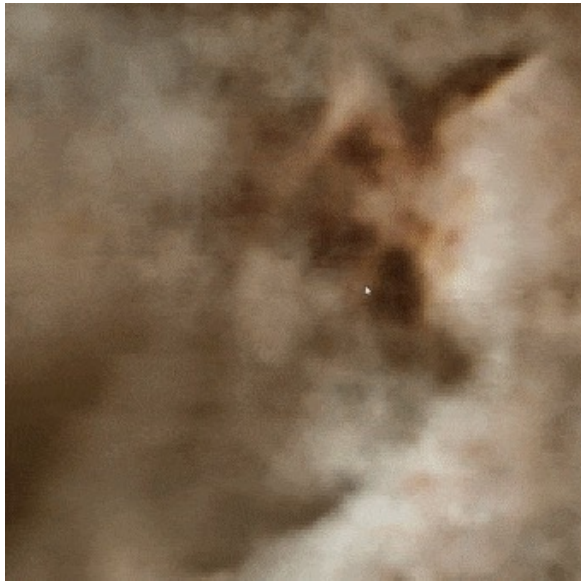


elephant

Image from: "Visualizing Neural Networks' Decision-Making Process", Towards data science

Deep Learning – 3D Reconstruction

Photogrammetry, NERFs and Gaussian Splatting



Images from: InstantNGP and “3D Gaussian Splatting: Performant 3D Scene Reconstruction at Scale”

Deep Learning – Generative AI

Stable Diffusion

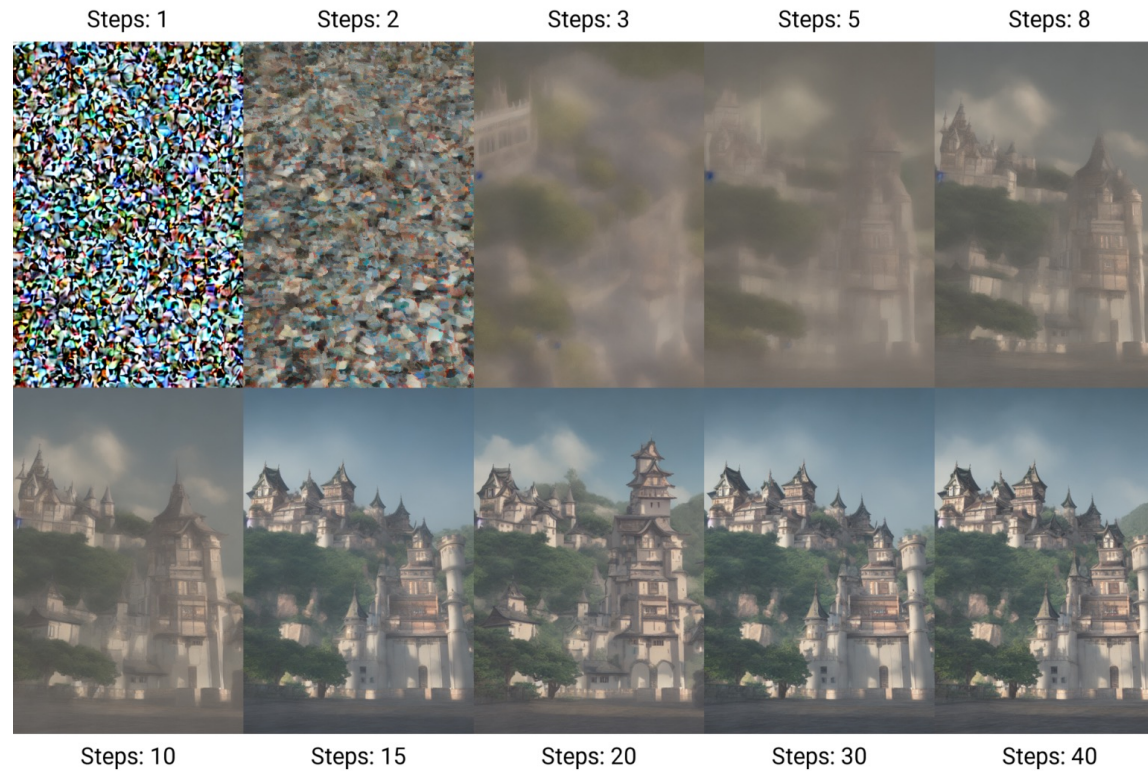
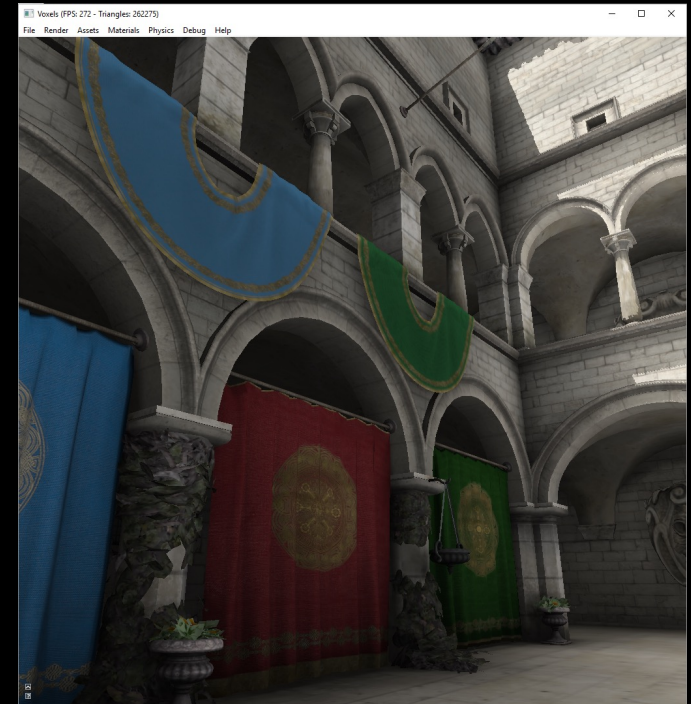
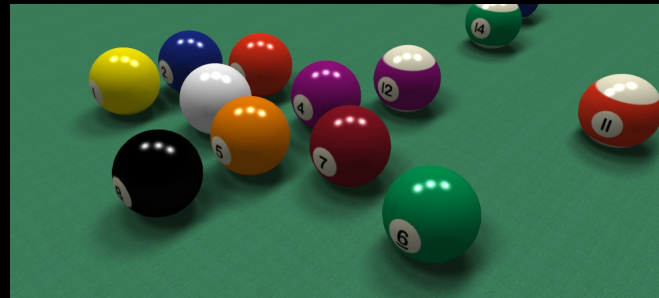


Image from https://en.wikipedia.org/wiki/Stable_Diffusion

And now for something completely different ...

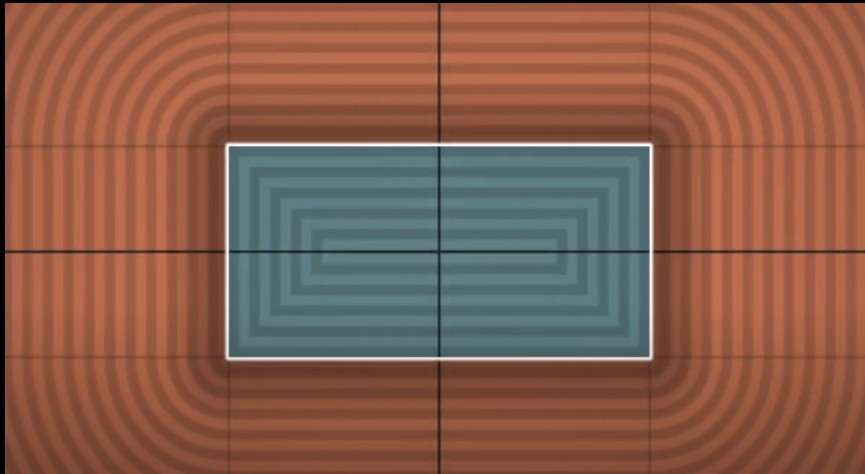


Rasterization - Shader Programing



Hybrid Rasterization

- Signed Distance Functions



**PAINTING
A LANDSCAPE**

WITH MATHS

$$sdf(\mathbf{p}) = \min(\text{terrain}(\mathbf{p}), \text{trees}(\mathbf{p}))$$

$$\text{trees}(\mathbf{p}) = d_e(\mathbf{w}, \mathbf{r}_e) +$$

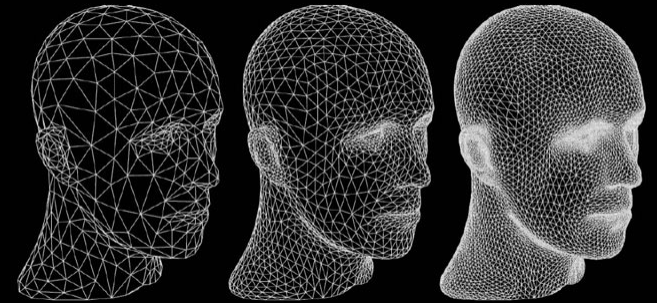
$$\mathbf{w} = \begin{pmatrix} x - \mathbf{c}_0 \\ y - f(\mathbf{c}_0, \mathbf{c}_1) \\ z - \mathbf{c}_1 \end{pmatrix}$$

$$\mathbf{c} = 2\mathbf{m} - 1/2 + \left\{ n \cdot \right.$$

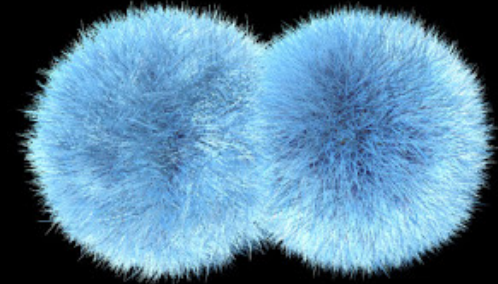
$$\mathbf{n} = \nabla sdf(\mathbf{p})$$

Imagens: Inigo Quilez

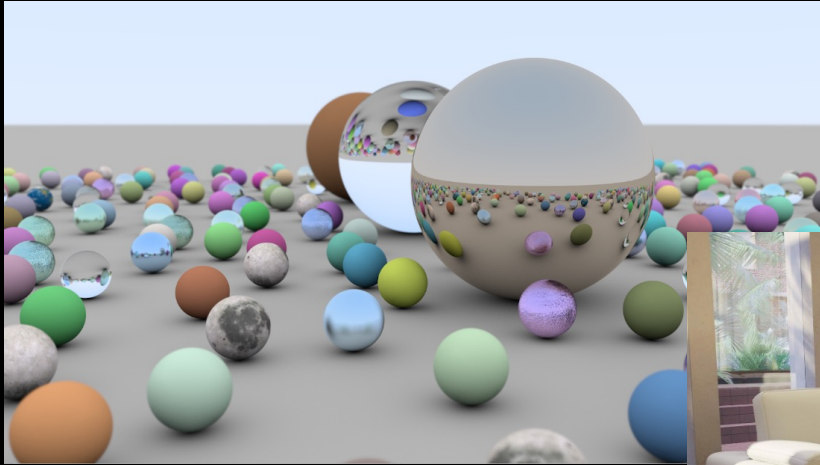
Rasterization AND Ray-Tracing



- Tessellation and geometry manipulation can be easily performed in a triangle/vertex based pipeline
- Illumination provides better results in a ray based pipeline
- DXR: Microsoft's all in one solution: Rasterization and Ray-Tracing in the same package
- OpenGL + Optix: NVIDIA's Optix is a ray-tracer that integrates well with OpenGL



Global Illumination Algorithms



Going full circle

- Main issue with Ray-Tracing:
 - To make it real time we can only shoot 1 or 2 rays per pixel
 - This produces a very noisy image
 - Deep Learning Denoiser for Ray-Tracing ;-)



Perfil CG

Docentes:

- António Ramires Fernandes (arf@di.uminho.pt)
- Luís Paulo Santos (psantos@di.uminho.pt)

Processamento de Imagem e
Visão por Computador
(ARF + LPS)

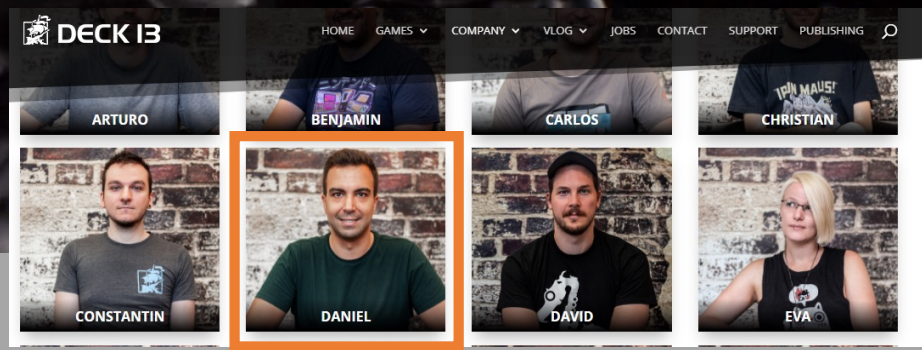
Iluminação e Visualização
(LPS)

Visualização em Tempo Real
(ARF)

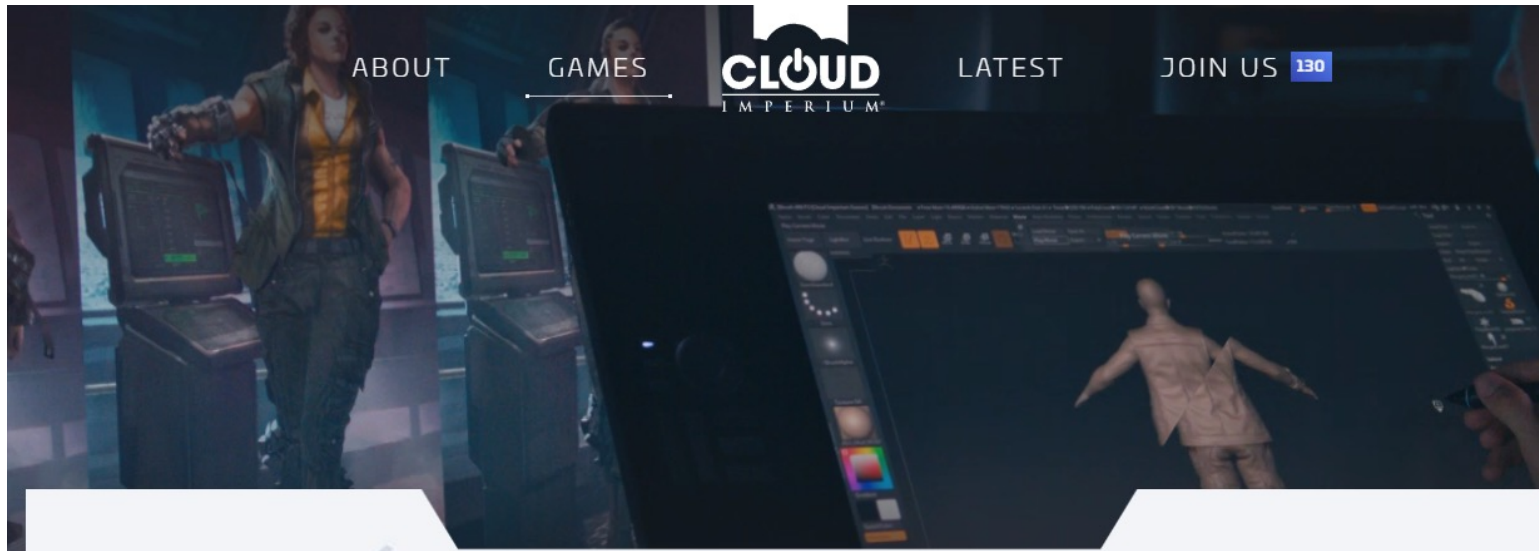
Ex-alunos do Perfil CG na industria de jogos

THE SURGE 2

VISIT WEBSITE



Daniel – Deck13 - Alemanha



Miguel Carvalho
Cloud Interactive
UK



The epic space sim

Star Citizen

We're creating a universe that combines the freedom of exploration, the thrill of combat, and the unique challenge of building a life in space. Star Citizen puts ultimate control in the hands of the player. Whether they're making their way as a cargo hauler, charting the great unknown, or scraping out a living outside the law, players will navigate through a mixture of procedurally generated and handcrafted worlds, interacting with a variety of compelling characters along the way.



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Nov 10, 2021



Announcements

Cloud Imperium Games to Open New Videogame Development Studio in Manchester, UK, in 2022



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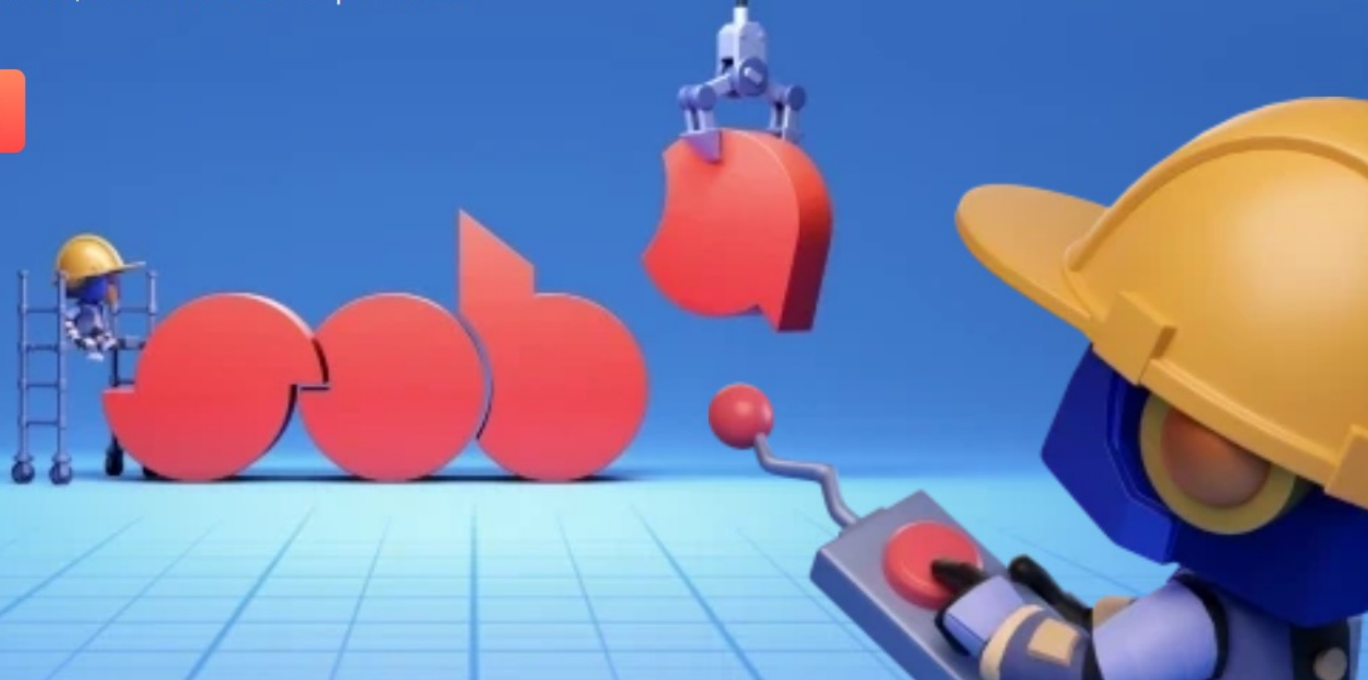


Build immersive, multiplayer games directly on your phone

Powerful no-code tools, available multi-platform

Join the waitlist

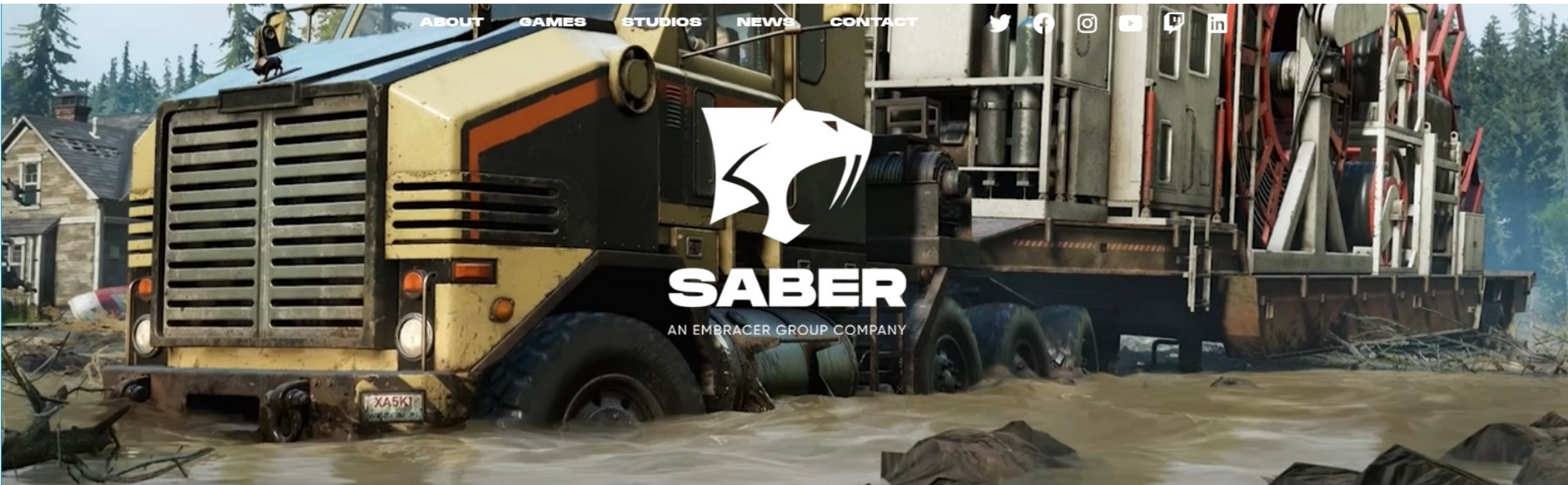
Get early access to the game



Carlos Brito
SOBA
Alemanha



Carlos Brito
Engineer



SABER

AN EMBRACER GROUP COMPANY

ABOUT

Saber Interactive is a U.S.-based developer and publisher of video games. Consisting of over 20 studios and more than 2,500 employees worldwide, we are one of the key operative business units of Embracer Group.

Creating and/or publishing games for all major platforms based on original and licensed IPs, Saber's current and upcoming titles include Warhammer 40,000: Space Marine 2, World War Z, Evil Dead: The Game, SnowRunner and A Quiet Place. Founded in 2001, Saber is also known for two decades of development partnerships with AAA publishers, producing The Witcher 3: Wild Hunt for Nintendo Switch, Halo: The Master Chief Collection, Crysis Remastered, and many others.

To stay in the loop on all of our upcoming announcements, please make sure you're following Saber across our official social channels.

César Perdigão
Saber Interactive
Vila do Conde

3D Graphics and Computer Vision

- António Ramires Fernandes (arf@di.uminho.pt)
- Luís Paulo Santos (psantos@di.uminho.pt)