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Using Generative Adversarial Networks to Reduce the Impact of Website Images

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HEALTH WARNING

THIS TALK CONTAINS A.I.

A.I. POSES SIGNIFICANT SOCIAL AND ENVIRONMENTAL RISKS

USE WITH CAUTION

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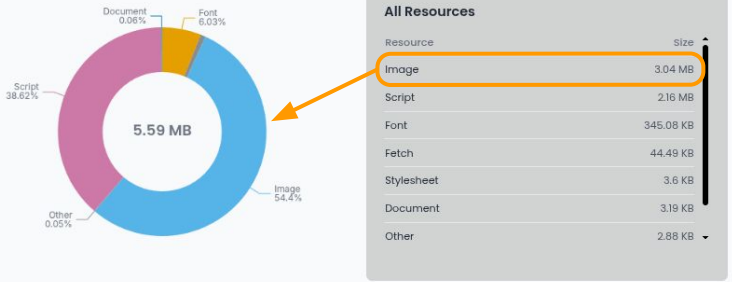
initialize	Preflight	0.0 KB	2161 ms
521.27715103.chunk.is	Script	40.7 KB	2271 ms

Resource Breakdown

Distribution of page resources by type and size, showing the composition of frontend assets



https://craigabbott.co.uk	200	0.08	0.09	1	0		A+	A+

Page Load Timeline

Synchronized view of CPU usage, color profiles, and network activity during page load

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Compression

Bitmap

48 kB

Webp

5.4 kB

Webp
+
gzip

5.4 kB

¼ Webp

<1 kB

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Compression

Webp

5.4 kB

¼ Webp

<1 kB

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Brains are pretty good!

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1/625th the amount of data!

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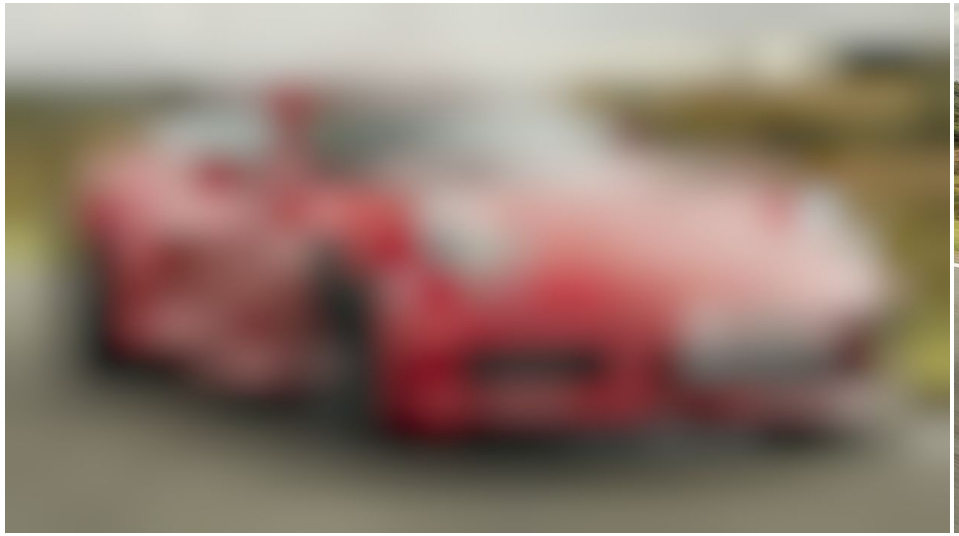
Brains are pretty good!



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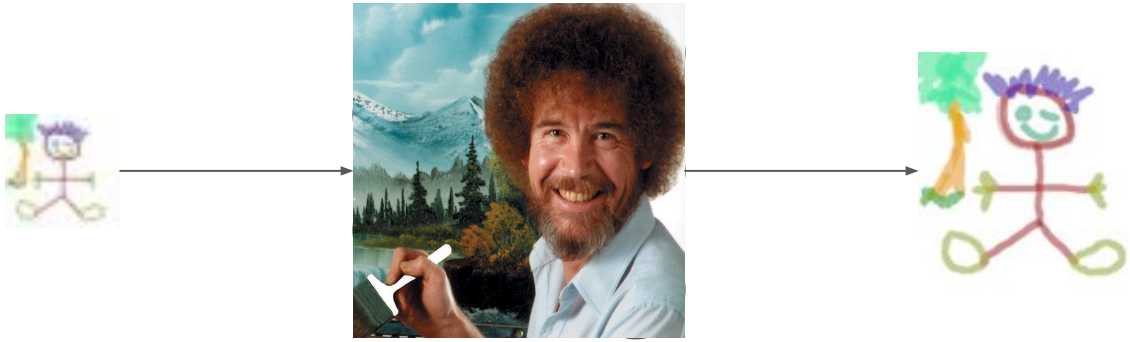
Machines can do it too!



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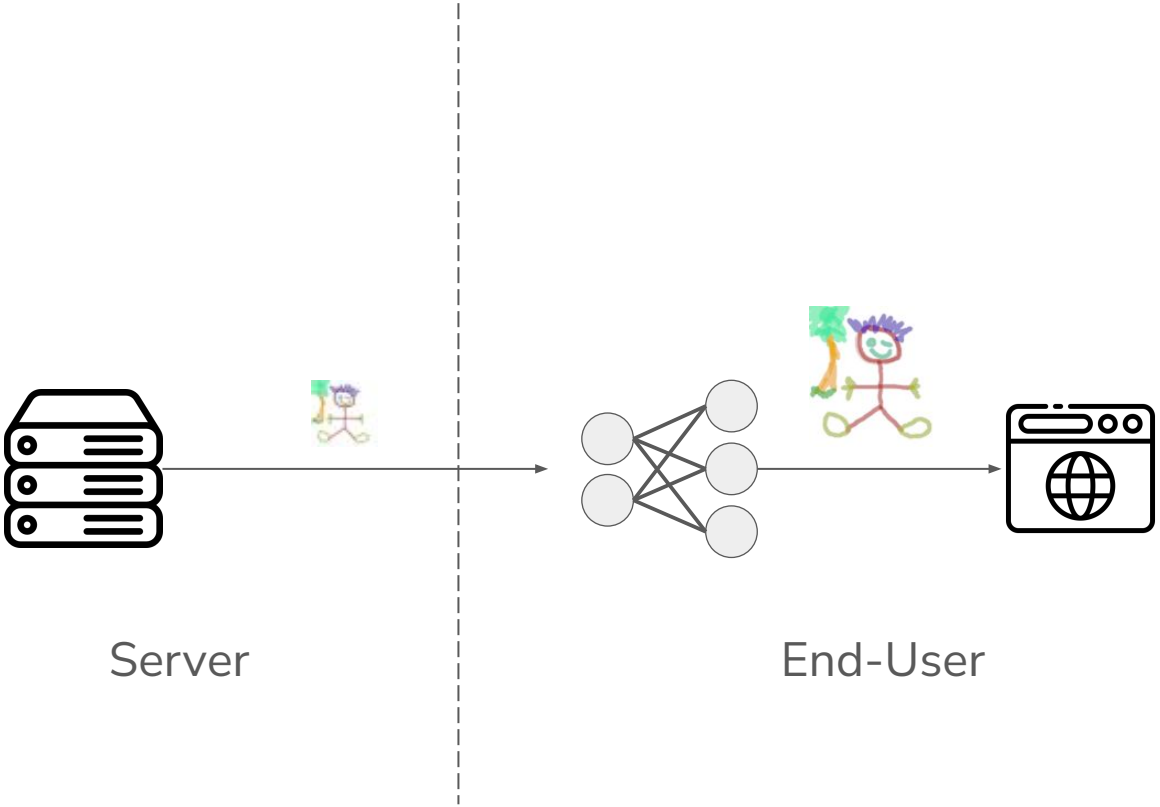
A Super Resolution Browser



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Transposed Convolutional Neural Network

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Transposed Convolutional Neural Network

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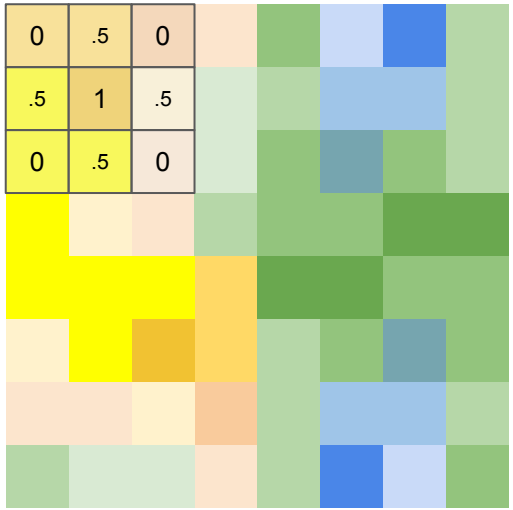
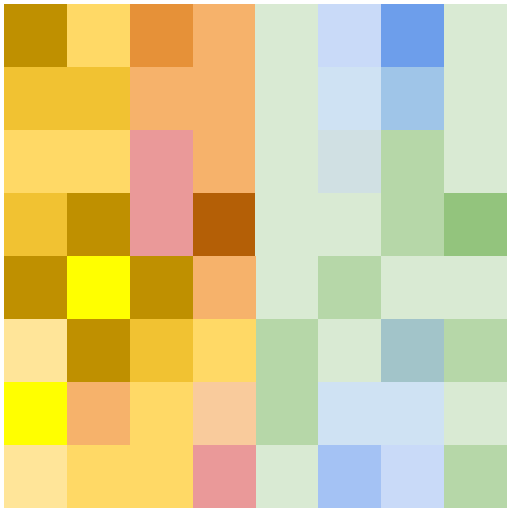
Convolutions

0	.5	0
.5	1	.5
0	.5	0

Filter



Pixel Space



Feature Space

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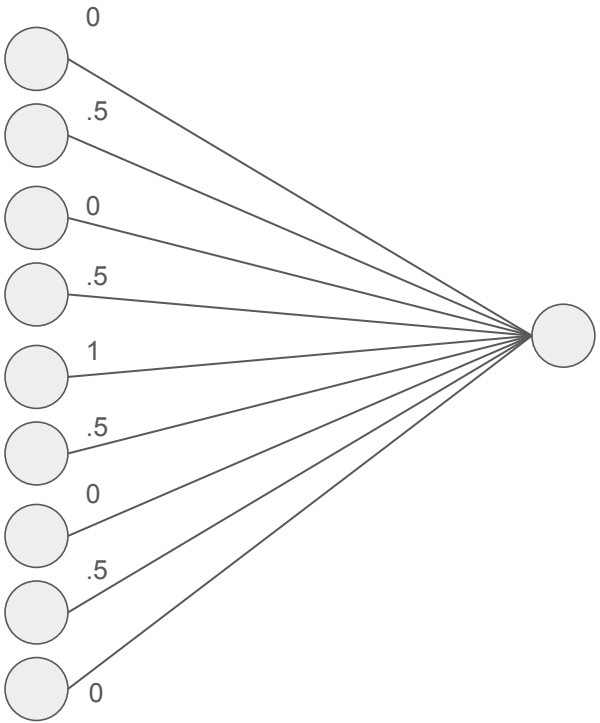
Convolutions

0	.5	0
.5	1	.5
0	.5	0



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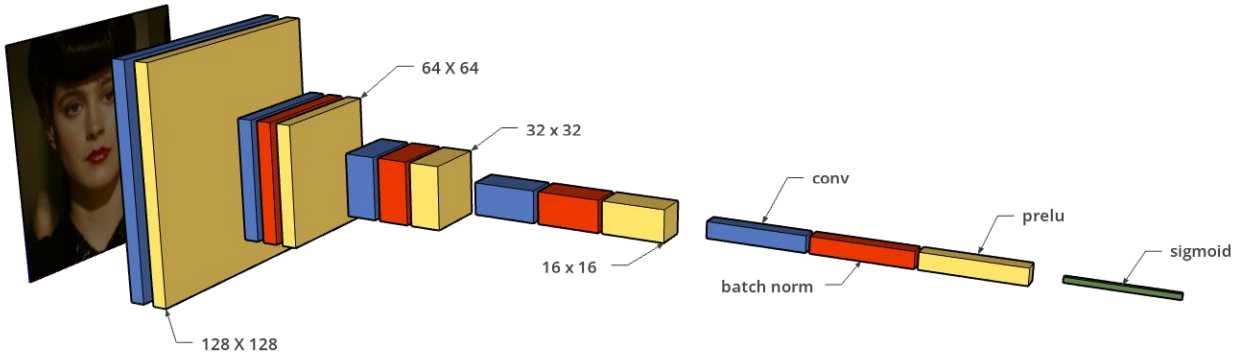
Discriminator Network



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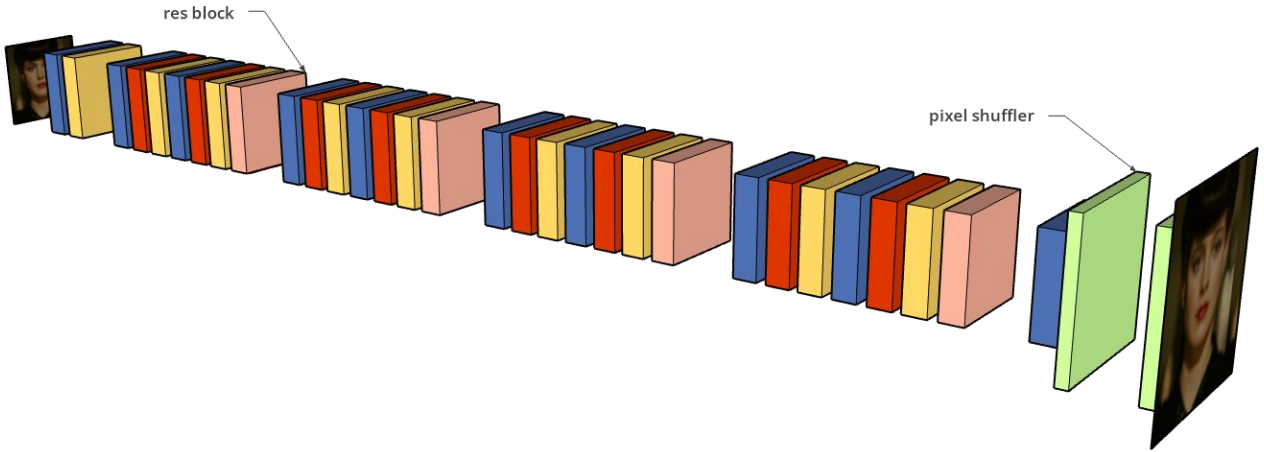
Generator Network



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Generative Adversarial Networks

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Artificial Neural Networks

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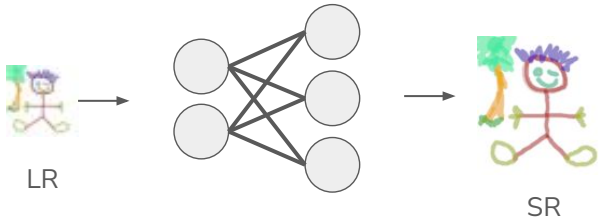
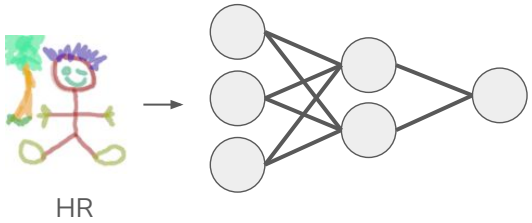
Generative Adversarial Networks

Generator



Discriminator



There's actually a third network
but that's complicated!!

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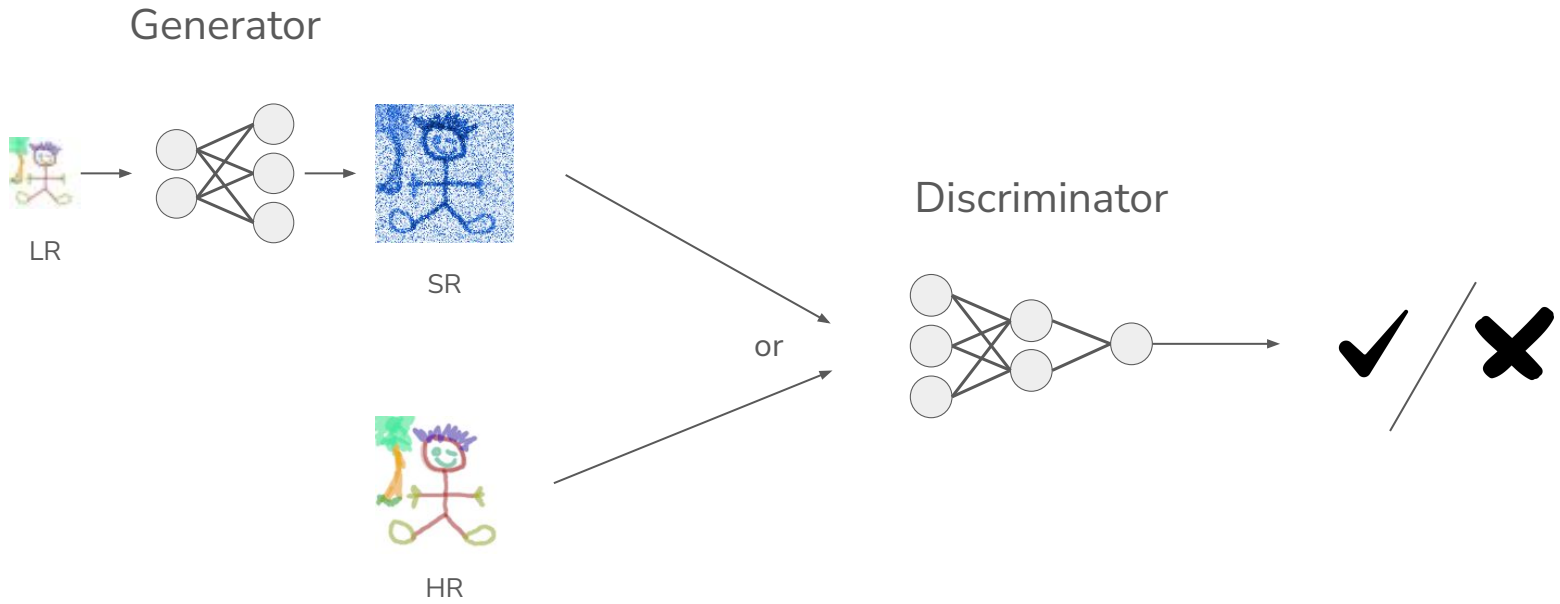
Generative Adversarial Networks



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Dev & Training

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Dev & Training

- Developed using Rust and Burn
- Dataset contained 3,450 images (DIV2K and Flickr2K)
- Trained on a single AMD Radeon RX 7600 (it took ages!)
- Trained over 20 epochs (~70,000 samples)

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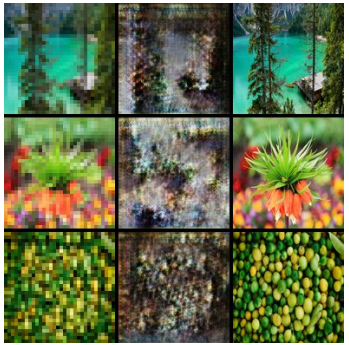
Training Results

Attempt 1



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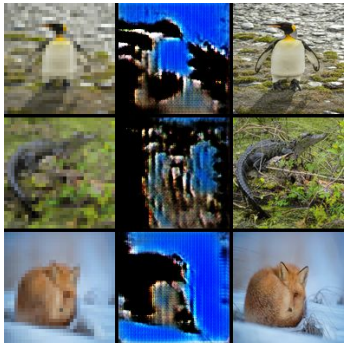
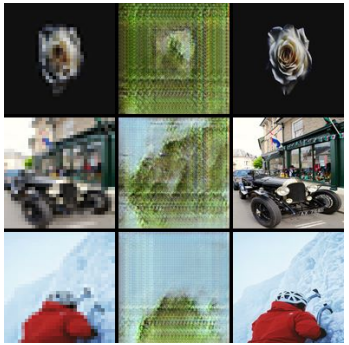
Training Results

Attempt 2



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Training Results

Attempt 101

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Now what?!

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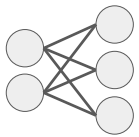
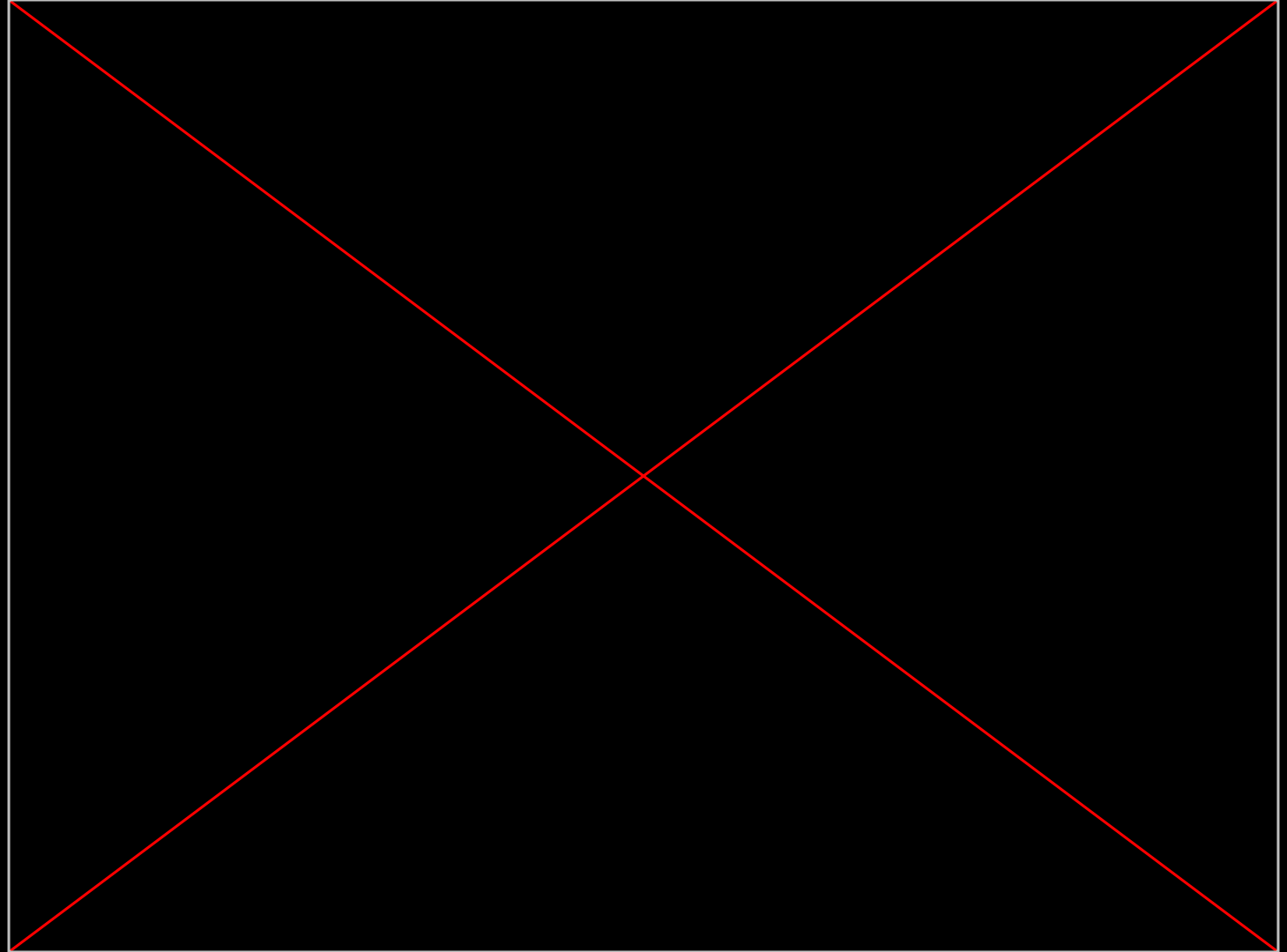
A Green(er) Web Browser

servo +  = Green Browser

- Open Source
- Made in Rust
- Experimental



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Does it save energy?

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Results

Inference: without any optimisation

CPU: **AMD Ryzen 7 3800X**

Avg utilisation: **28%**

Avg time per image: **0.13 secs**

Energy consumption: **1 mWh**

GPU: **AMD Radeon RX 7600**

Avg utilisation: **73%**

Avg time per image: **0.015 secs**

Energy consumption: **0.5 mWh**

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Results

Data transfer saving

Avg high-res size: **35.7 KB**

Avg low-res size: **2.9 KB**

Avg reduction: **35.7 - 2.9 = 32.8 KB**

Transfer energy intensity: **0.041 mWh/KB**

Energy saving: **32.8 * 0.041 = 1.34 mWh**

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Average Saving

25% - 63%