# “Request for Plot”: is **softmax cross-normalization** fruitful in transformers?

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Dataflow Matrix Machines project

`https://github.com/anhinga`

I am looking for collaborators

# "Request for Plot"

Replace

$$\text{Attention}(Q, K, V) = \text{softmax}(cKQ^{\mathsf{T}})V$$

with

$$\text{Attention}(Q, K, V) = \text{softmax}(cKQ^{\mathsf{T}})\text{softmax}^{\mathsf{T}}(V)$$

Does your favorite learning curve improve?

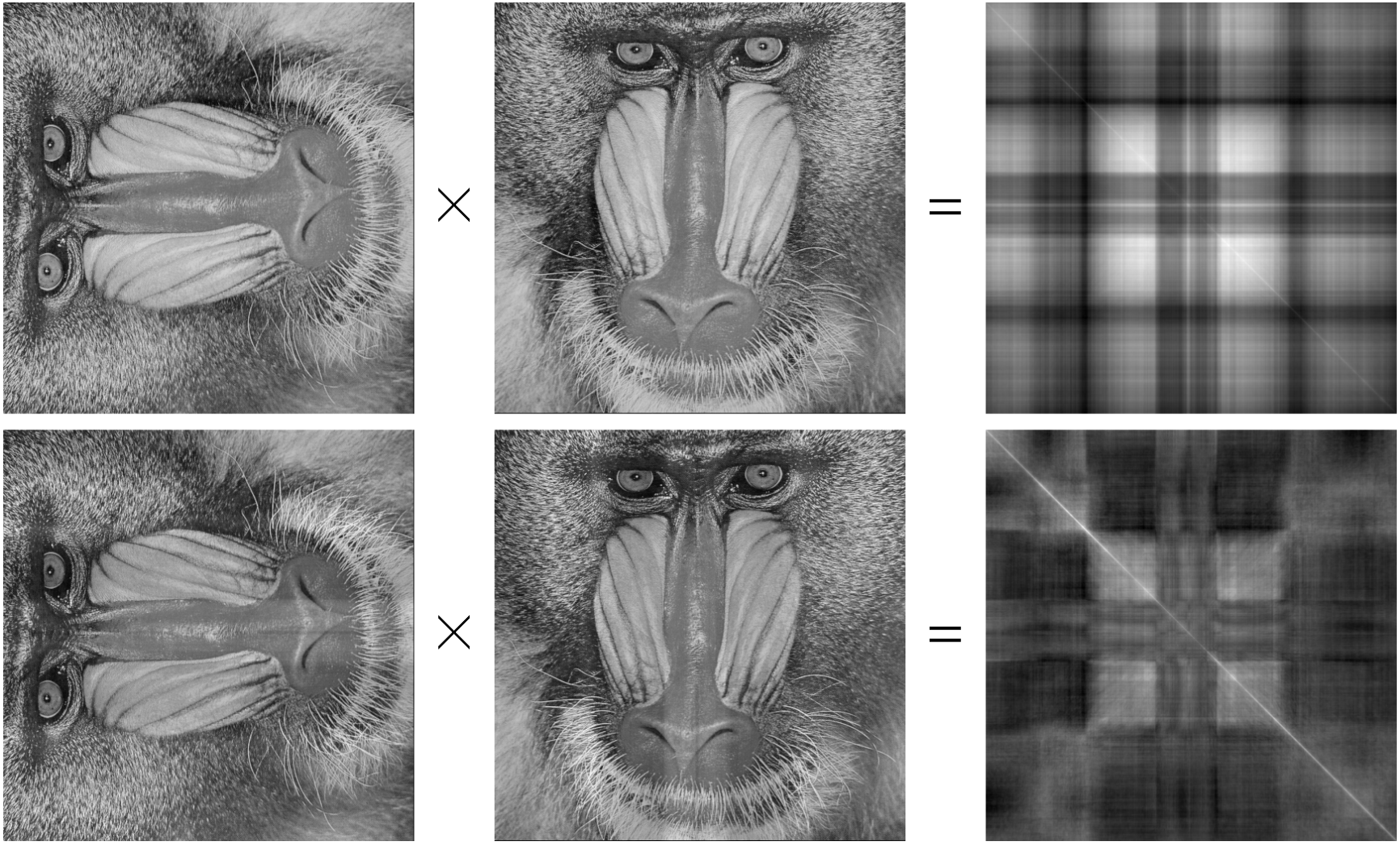
Why do I think this is a good shot?

# Why this might be a good idea?

I experimented with interpreting monochrome images as matrices and multiplying those matrices via matrix product and checking whether results are visually interesting.

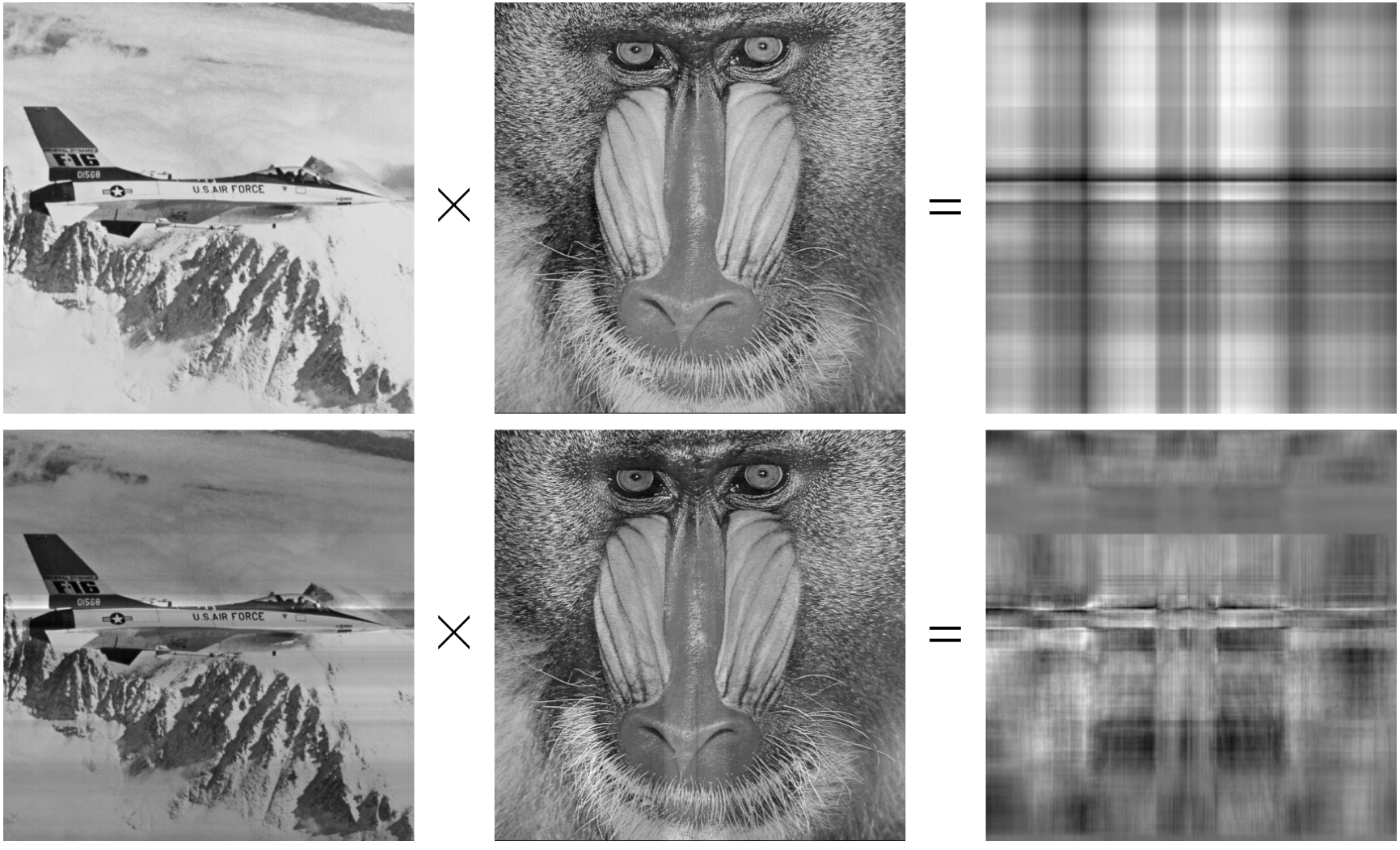
**Multiplying monochrome images as matrices:**
**A*B and softmax**

`https://github.com/anhinga/JuliaCon2021-poster`



In Transformers people sometimes **softmax** rows of the left matrix: $\text{Attention}(Q, K, V) = \text{softmax}(cKQ^T)V$ from "Attention Is All You Need" (2017).

In the second example we **softmax** rows of the left matrix **and** columns of the right matrix resulting in products with richer, more fine-grained structure.

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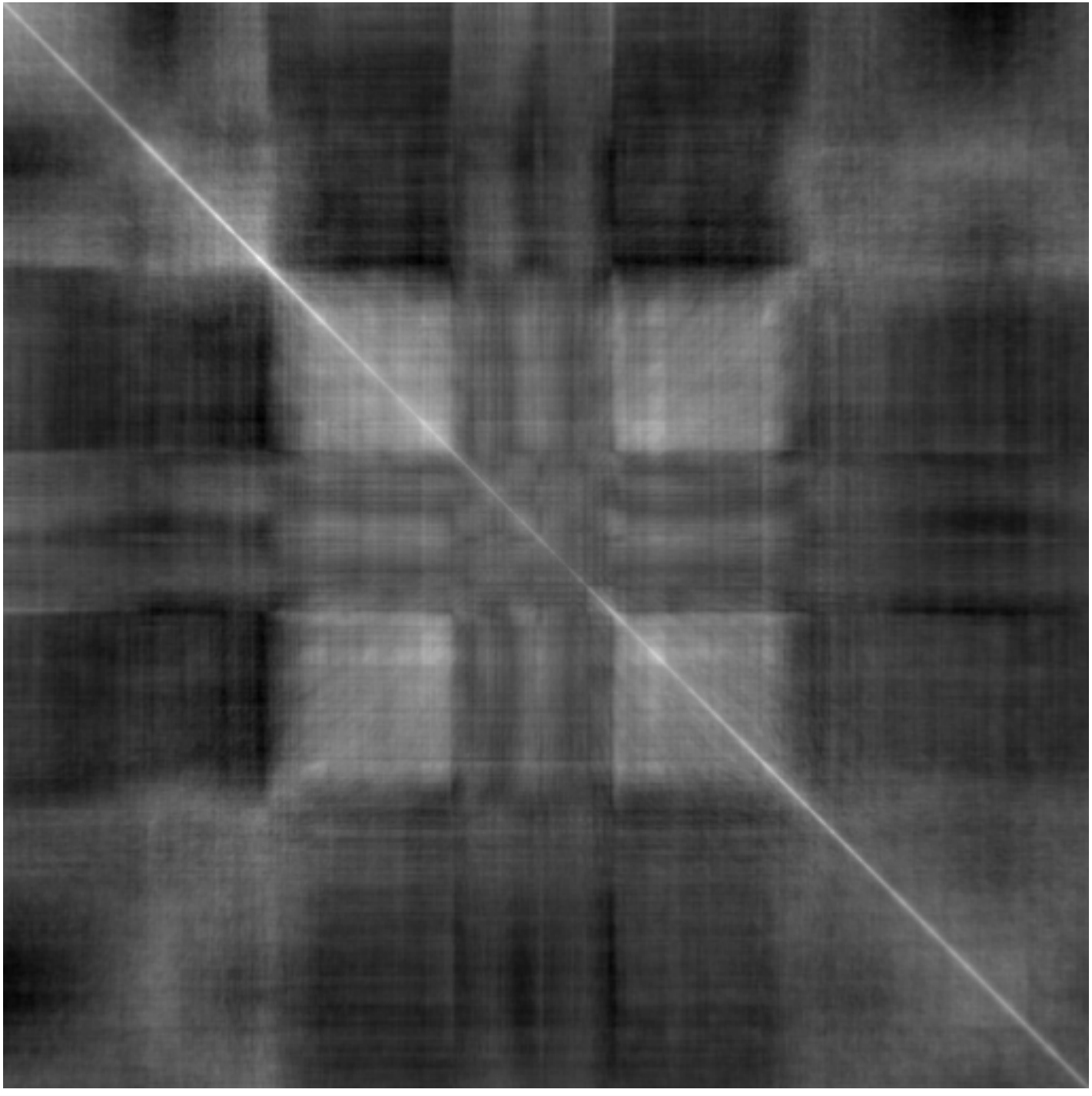

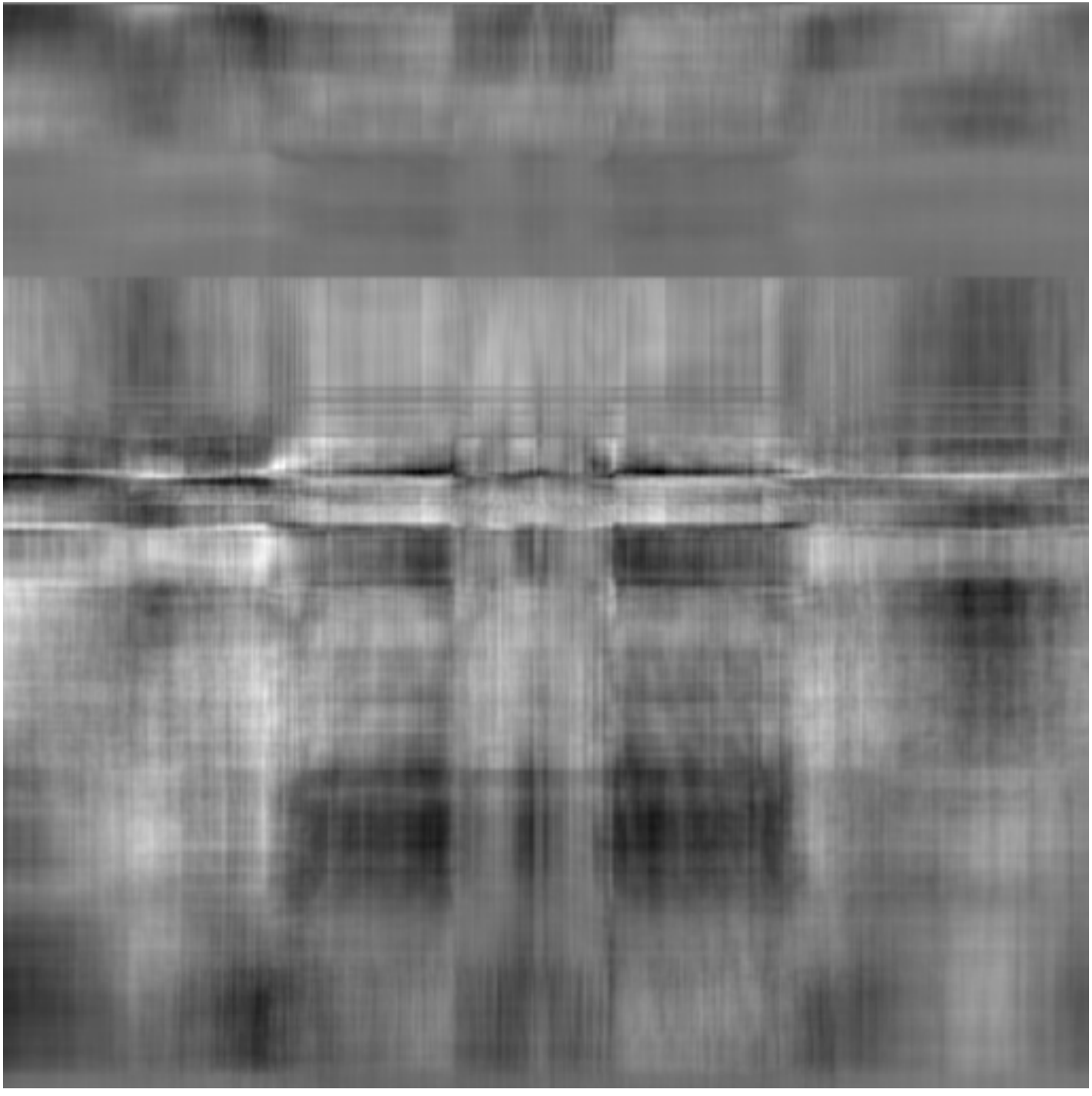

# Cross-normalization

values are horizontal stripes

**cross-norm:** softmax vertical vectors

a vertical vector consists of $i$'s coords of all values for a given $i$

# Remix with classical Transformer attention

Various ways to remix, e.g.

$$\alpha * \text{softmax}^{\mathsf{T}}(V) + (1 - \alpha) * (V)$$

I originally thought about training Transformers from scratch when creating this RFP.

But if one starts with $\alpha = 0$ and increases $\alpha$ gradually, then one should be able to try fine-tuning a classical pretrained Transformer while deforming it from $V$ towards $\text{softmax}^{\mathsf{T}}(V)$.

# Contact

Open an issue in

`https://github.com/anhinga/JuliaCon2021-poster`

or send an e-mail to bukatin @ cs dot brandeis dot edu