Otto Dobretsberger, PhD

Sr. Software Dev at CODE Consulting

CODE CONSULTING CODE STAFFING CODE MAGAZINE CODE TRAINING

CODE PRESENTS
CODE CONSULTING
CODE MAGAZINE
CODE GROUP
CODE STAFFING
"Helping People Build Better Software"
CODE TRAINING

About Otto Dobretsberger

CODE PRESENTS

- Sr. Software Dev @ CODE (15+ years)
- Degrees in Biomedical Science and Computer Science
- Professor @ University of Houston (10+ years)
- Author, Speaker and Presenter

- 2x World Record holder in Bench Press

- Email: ottod@codemag.com

About CODE Consulting

CODE CONSULTING

- Custom Software Development
- Artificial Intelligence
- Web, Cloud, Mobile, Desktop, Serverless, Databases,…
- Copilot Development, AI, GPT & Azure OpenAI
- Application Security Testing
- User Interface and Interaction Design
- Project Rescue, App Modernization (VB, VFP, Access, etc.)
- Support & Maintenance for existing applications

Gulfstream
A GENERAL DYNAMICS COMPANY

wisetech global

Microsoft

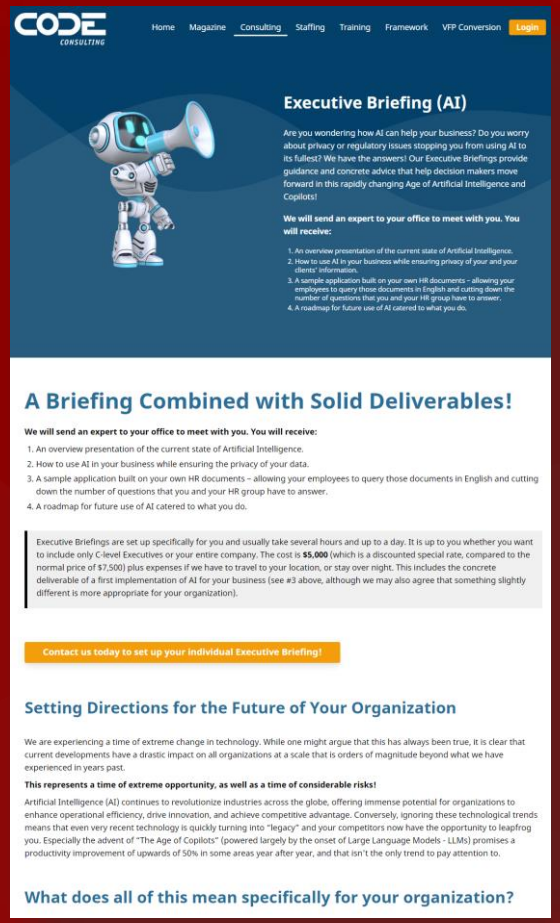
eog resources

BRIDGESTONE

BLUE BELL ICE CREAM EST 1907

Solera

AI Consulting Services



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- We can help with your AI needs
- What does AI mean for you?
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- www.codemag.com/AI
- www.codemag.com/ExecutiveBriefing

CODE Staffing

- Disrupting the world of staffing!
- Giving our customers the ability to have staff on par with Silicon Valley companies…
- …and our employees a work environment in a bleeding-edge tech company with the **industry leading benefits**!

- www.codestaffing.com

We Need You!

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Upcoming Events

- State of .NET Online - .NET 8 – November 15th 2023
- https://www.codemag.com/StateOfDotNet

- CODE Presents – October 25th 2023:
  Harnessing Large Language Models Locally
- https://www.codemag.com/CODEPresents

Free Subscription!

CODE MAGAZINE

- The leading software development magazine written by expert developers for developers.
- All registered attendees will automatically receive a free digital subscription to CODE Magazine – no need to do anything, it'll happen auto-magically.
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Event Survey – Win $100!

- Complete this very short 12 question survey for a chance at a $100 Amazon Gift Card!
- Survey must be completed by 11:59pm ET on Friday 10/6/2023 to be eligible!
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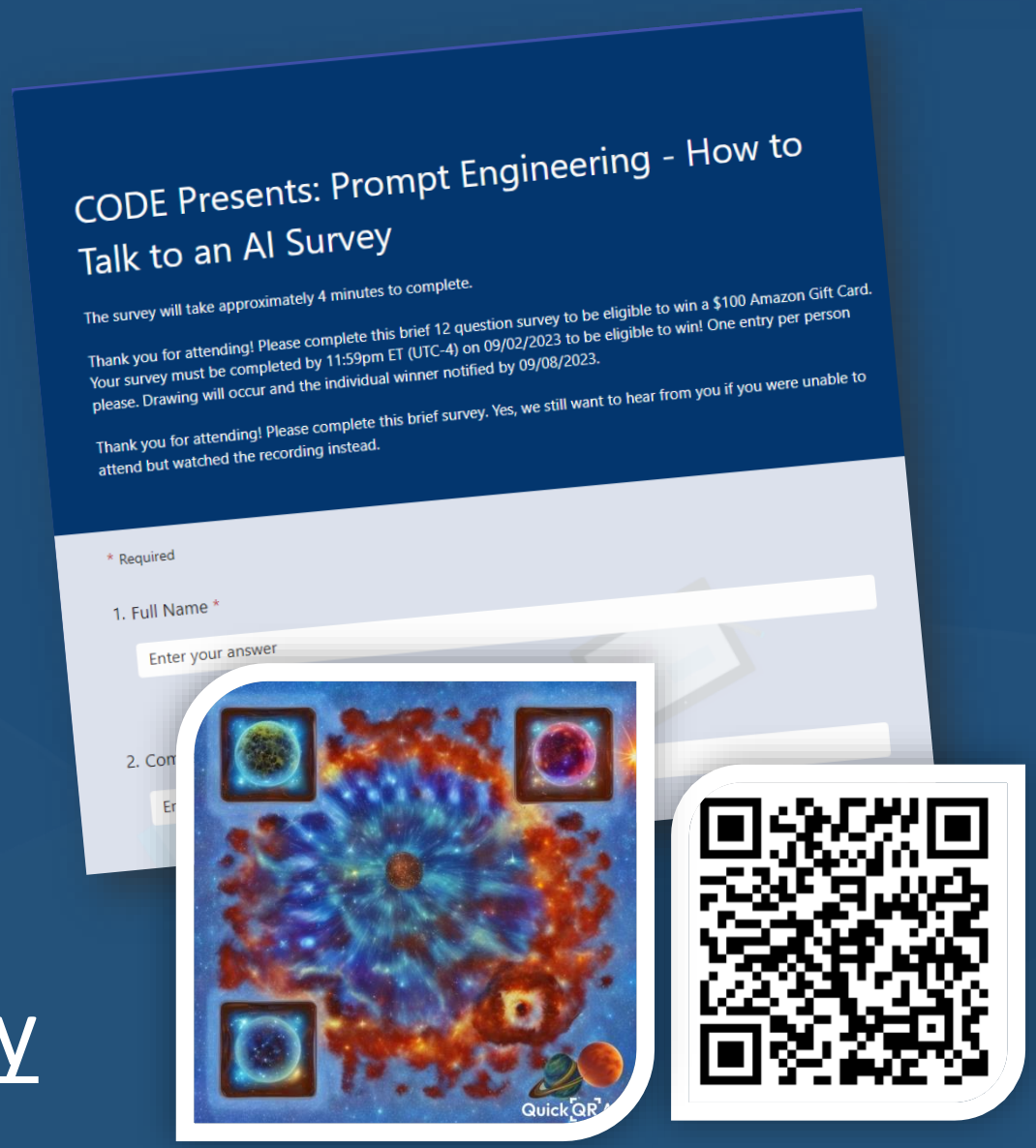

https://bit.ly/CP10423Survey

Thank you for attending!

CODE PRESENTS

- Welcome new attendees!
- Welcome repeat attendees!
  - We now have quite a number of people who attended 50+ events
- Our AI presentations are the most popular we have ever done
  - …and we have been at this for 30 years!
- Based on the attendee list, I am guessing we have a mix of developers, decision makers, and users

Agenda

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1. **Introduction**
    - Brief introduction to Generative AI and its importance
    - Contextualizing Image Generation within Generative AI
    - Goal of the presentation
2. **Historical Evolution of Generative Models**
    - Brief history of generative models (with emphasis on image generation)
    - Transition from early models to advanced architectures
3. **Understanding Key Generative Models**
    - Introduction to Generative Adversarial Networks (GANs)
    - Introduction to Variational Autoencoders (VAEs)
4. **Running a Simple Generative Model**
    - Preparing the environment and data
    - Training a simple model for image generation
    - Discussing the parameters influencing the model's outcomes
5. **Demonstration: Generating Images**
    - Demonstration of generating images using a pre-trained model
    - Exploring the parameter settings and observing the outcomes
6. **Discussion: Capabilities and Limitations**
    - Discussing the strengths and weaknesses of current generative models
    - Future trends in generative AI for image generation

Introduction

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- Importance of Generative AI for Image Generation
- Contextualizing Image Generation
- Goal of the presentation

Historical Evolution

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- Early Efforts: RBM (Restricted Boltzmann Machines)
- Introduction of Generative Adversarial Networks (GANs)
- Variational Autoencoders (VAEs)
- Improvement of GANs
- Flow based models
- Performance Benchmarks and App Driven Development
- Ethical Considerations
- Recent Advancements
- Open Source

Understanding Key Generative Models

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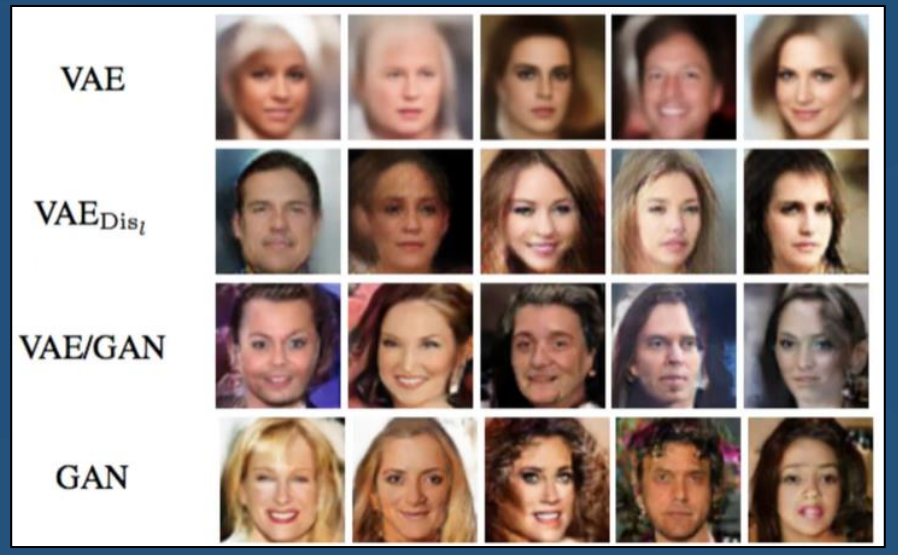
GAN vs. VAE



Sik-Ho Tsang

Generative Adversarial Networks (GANs)

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Generative Adversarial Networks (GANs)

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- Generator – artist who tries to create a convincingly fake painting
- Discriminator – art critic who tries to tell if the painting is real or fake

For How Long?

Generative Adversarial Networks (GANs)

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- Learning Process: Cat and mouse game
  - Generator improves fakes
  - Discriminator improves at spotting fakes
- Training improves both sides
  - Feedback Loop
  - Convergence
  - Objective Measurement
  - Human Intervention (optional)

Variational Autoencoders (VAEs)

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- More orderly and structured
- More like a skilled artist who studies and learns from real images to create new ones
- Study of images and their attributes (style, patterns, features, brushes, color palette)
- Create blueprint & recipe
- New Image Generation (batch)
- Evaluation

It’s never just one!

- All modern image generation services make use of both.
- Different emphasis and focus
- These concepts are NOT new!

AI Models and Timelines

Model	Notable AI products	Research Paper	Details
VAE	Amazon Alexa, Google Photos, Spotify	Dec 2013	Kingma & Welling "Auto-Encoding Variational Bayes"
GAN	AlphaGo, DALL-E, NVIDIA StyleGAN	Jun 2014	Goodfellow & Bengio et al. "Generative Adversarial Networks"
Flow models	Google Pixel 4, GPT-3, NVIDIA StyleGAN	May 2016	Dinh & Bengio et al. "Density estimation using Real NVP"
Transformer	BERT, Google Translate, OpenAI's GPT models	Jun 2017	Vaswani & Polosukhin et al. "Attention is All You Need"
Diffusion	DALL-E 2, Midjourney, Stable Diffusion	Jun 2018	Gregor & Weber et al. "Temporal Difference Variational Auto-Encoder"

col_jung Medium Col Jung

Running a simple generative model

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- Preparing the environment and data
  - Environment setup
  - Data collection
  - Data pre-processing
- Training a simple model for image generation
  - Model architecture
  - Training procedure
  - Evaluation during training

AI vs AI

Parameters influencing the model's outcomes

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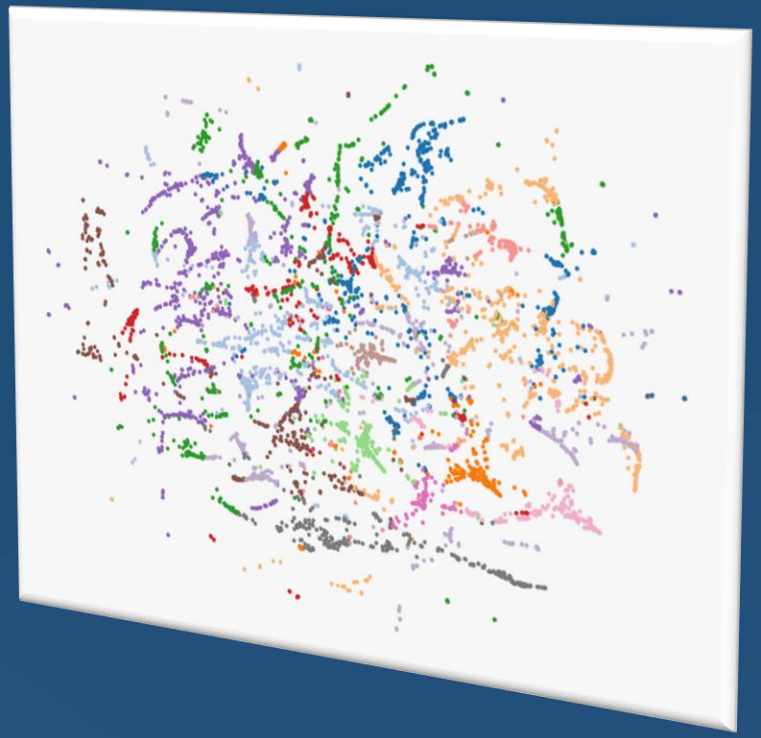
- Hyper-Parameters
- Regularization
- Loss Functions
- Optimization Algorithms & Algorithm Optimization
- Exploration of Latent Space

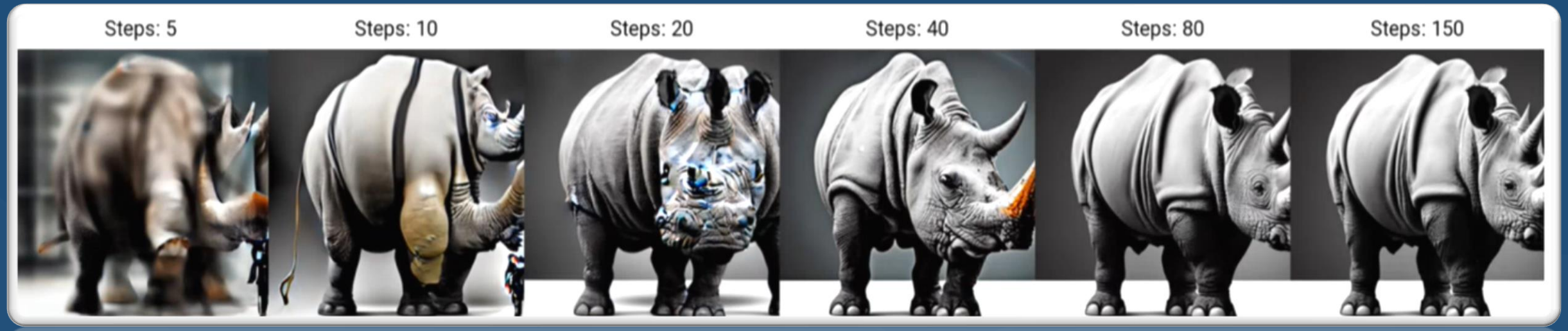
Generating images

- Pretrained Text Embeddings – Text To Vector
- Example: Rhino
  - Gray
  - 4 thick legs
  - 1 or 2 horns
  - Short tail
  - Skin texture
  - Postures
  - Etc.



Generating Images

uxplanet.org



Running Stable Diffusion Local

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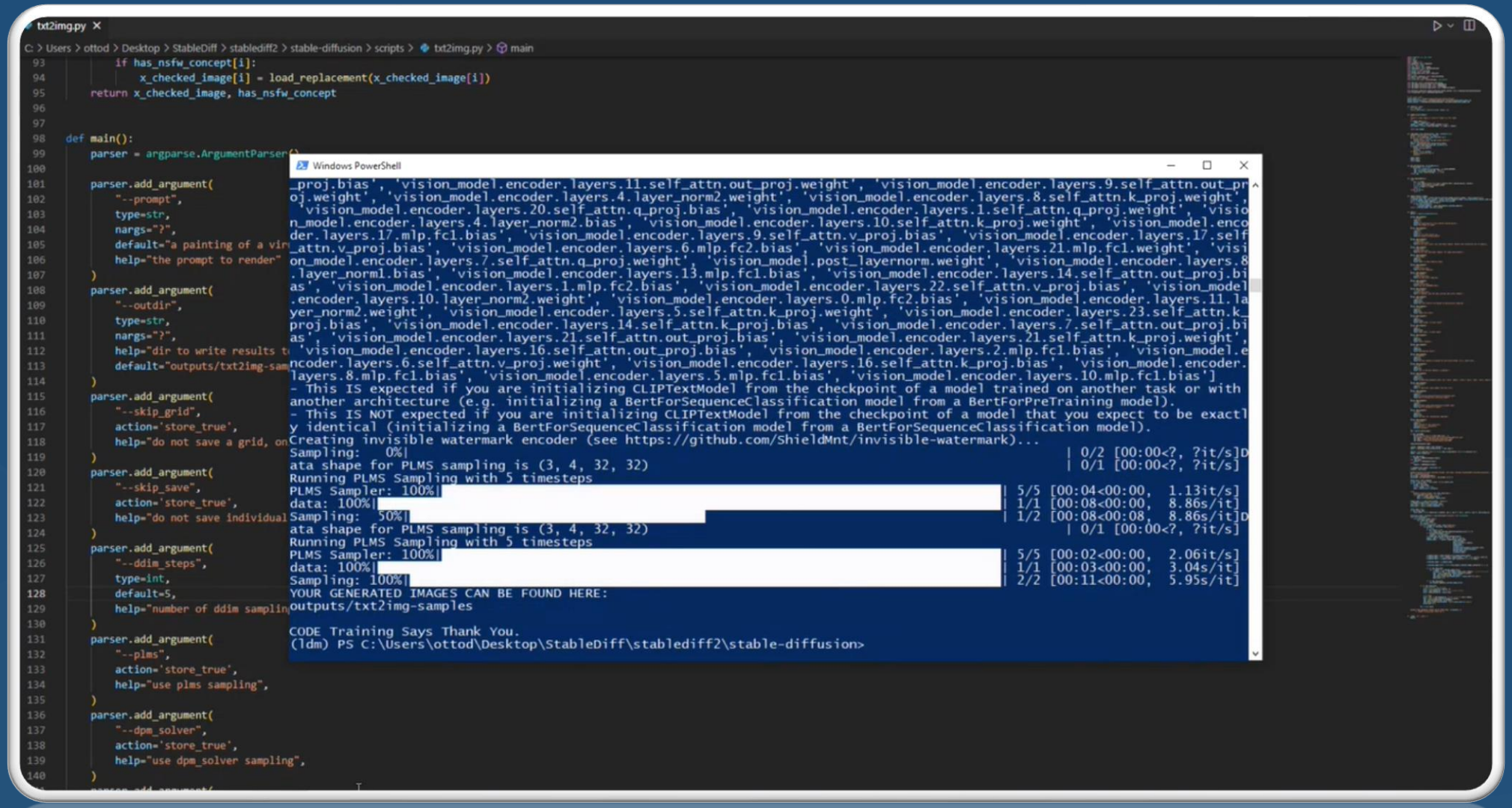


Example results

Blue car on moon

Red flower on ship

Kangaroo on mountain

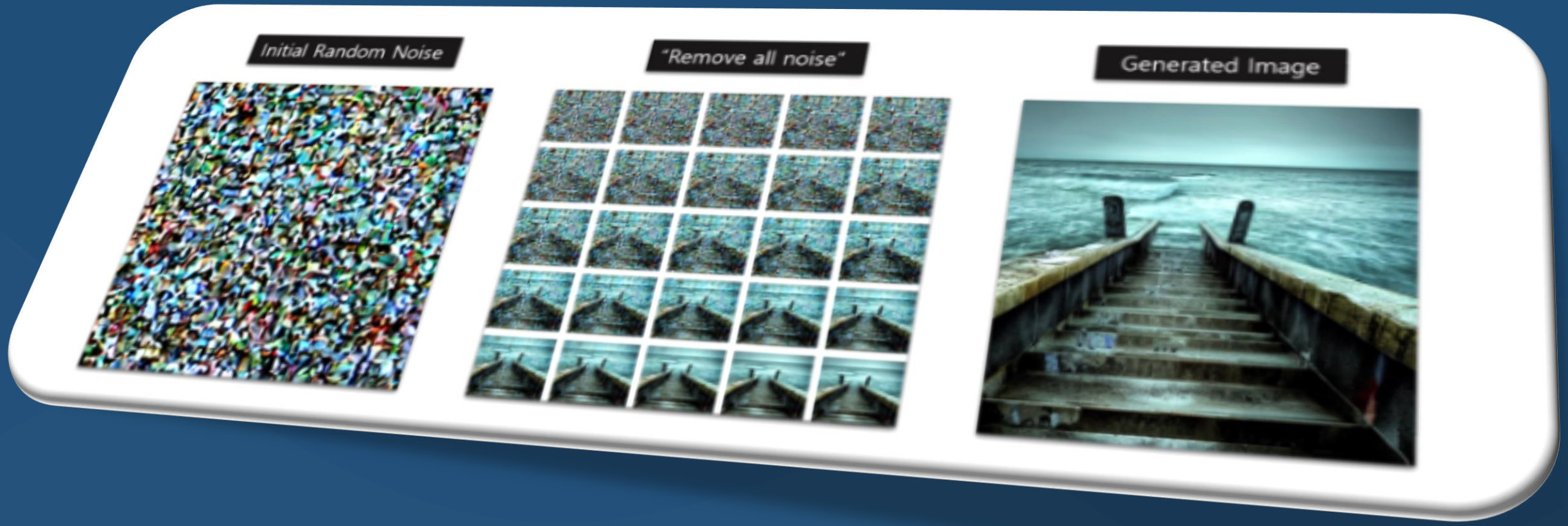
6 images, each with 50 steps

Step Reduction

5 steps

50 steps

From noise to image



Chris McCormick

Prompt engineering

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"astronaut cat, playing piano in space, black hole in the background, high quality, 4k render, dramatic light, photoreal, detailed, pov shot, volumetric lighting, golden hour"

"astronaut cat, playing piano in space, black hole in the background"

Leonardo.Ai with Alchemy

Service comparison

A dynamic action scene of a knight battling a dragon on a cliffside, with roaring waves below, inspired by the Romanticism movement, reminiscent of the works of Eugène Delacroix.

Midjourney

Nightcafe

Adobe Firefly

Leonardo

No settings changed, default parameters

Dreamshaper 8
(local)

Local & personal cloud setup with Stable Diffusion

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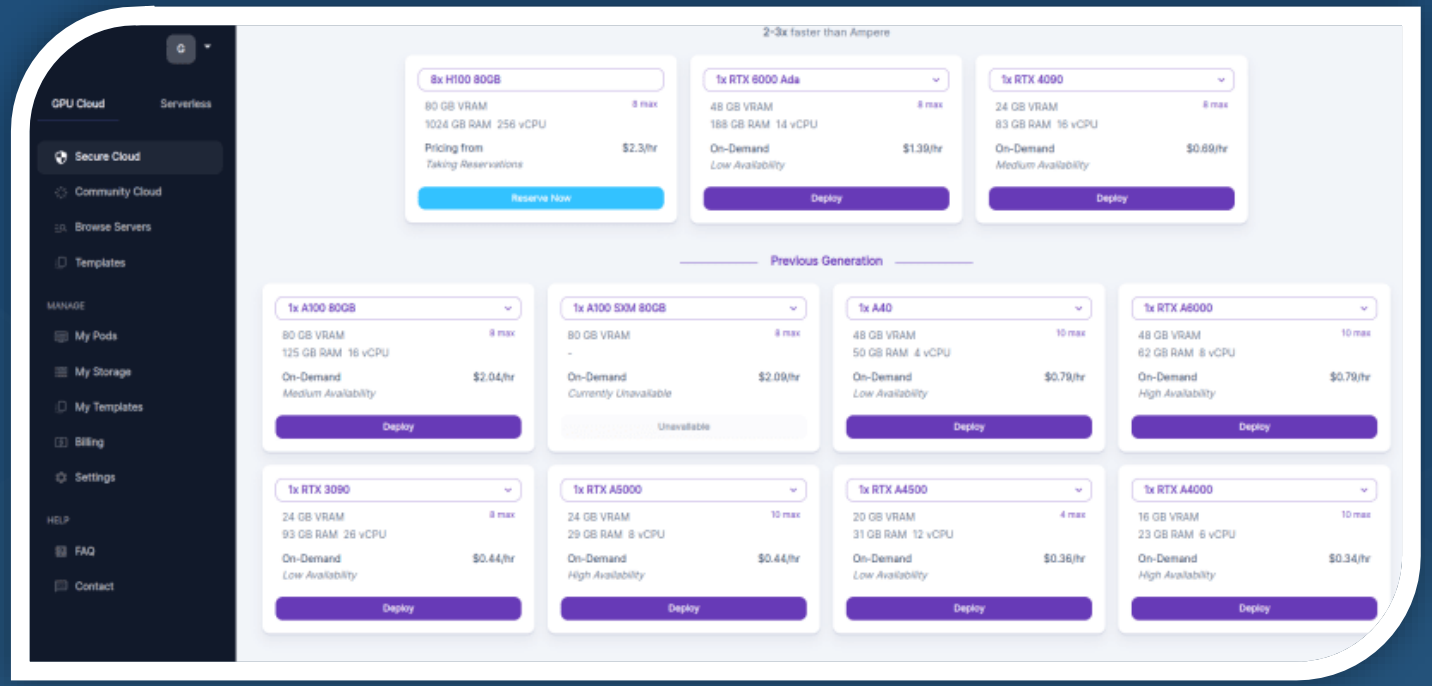
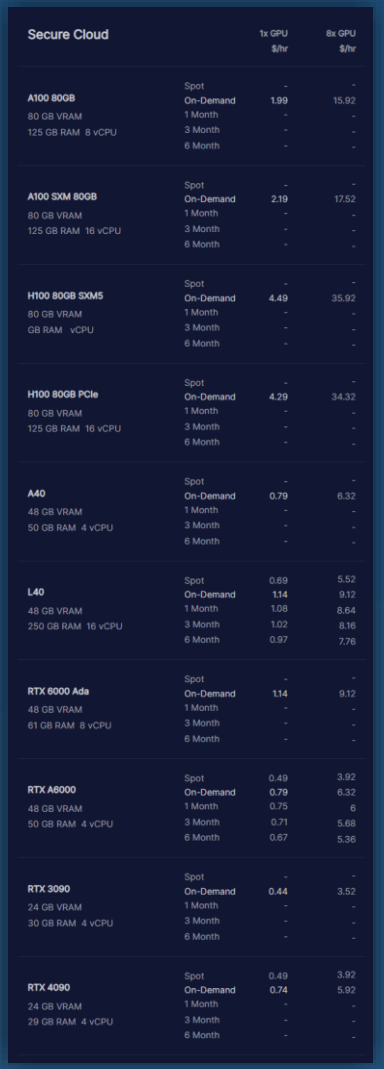
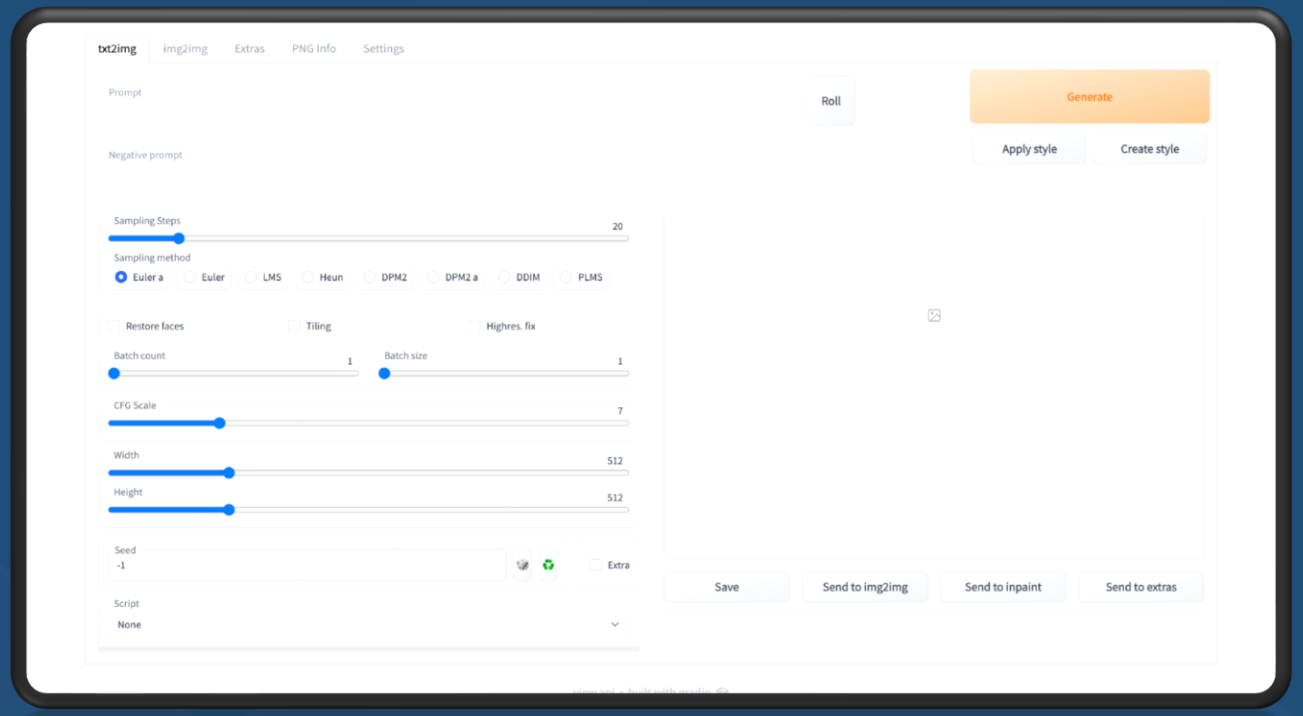
- For instance, on RunPod





Web UIs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PLMS
Restore faces
Tiling
Highres. fix
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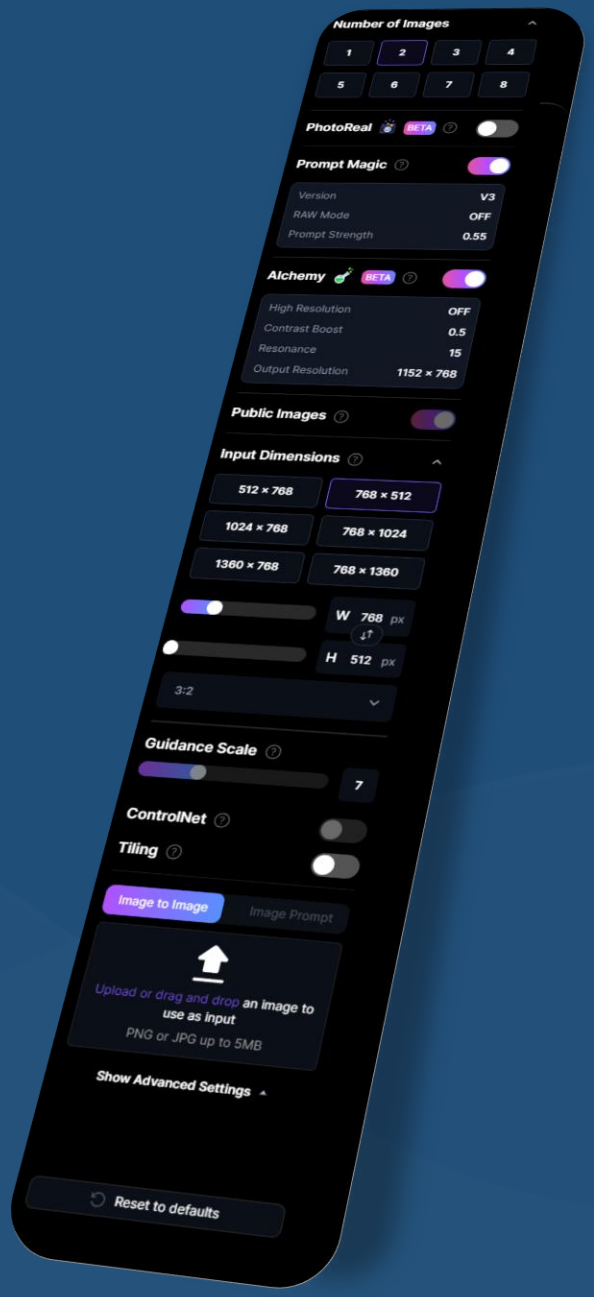
Send to inpaint
Send to extras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Contrast Boost
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Resonance
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Public Images
Input Dimensions
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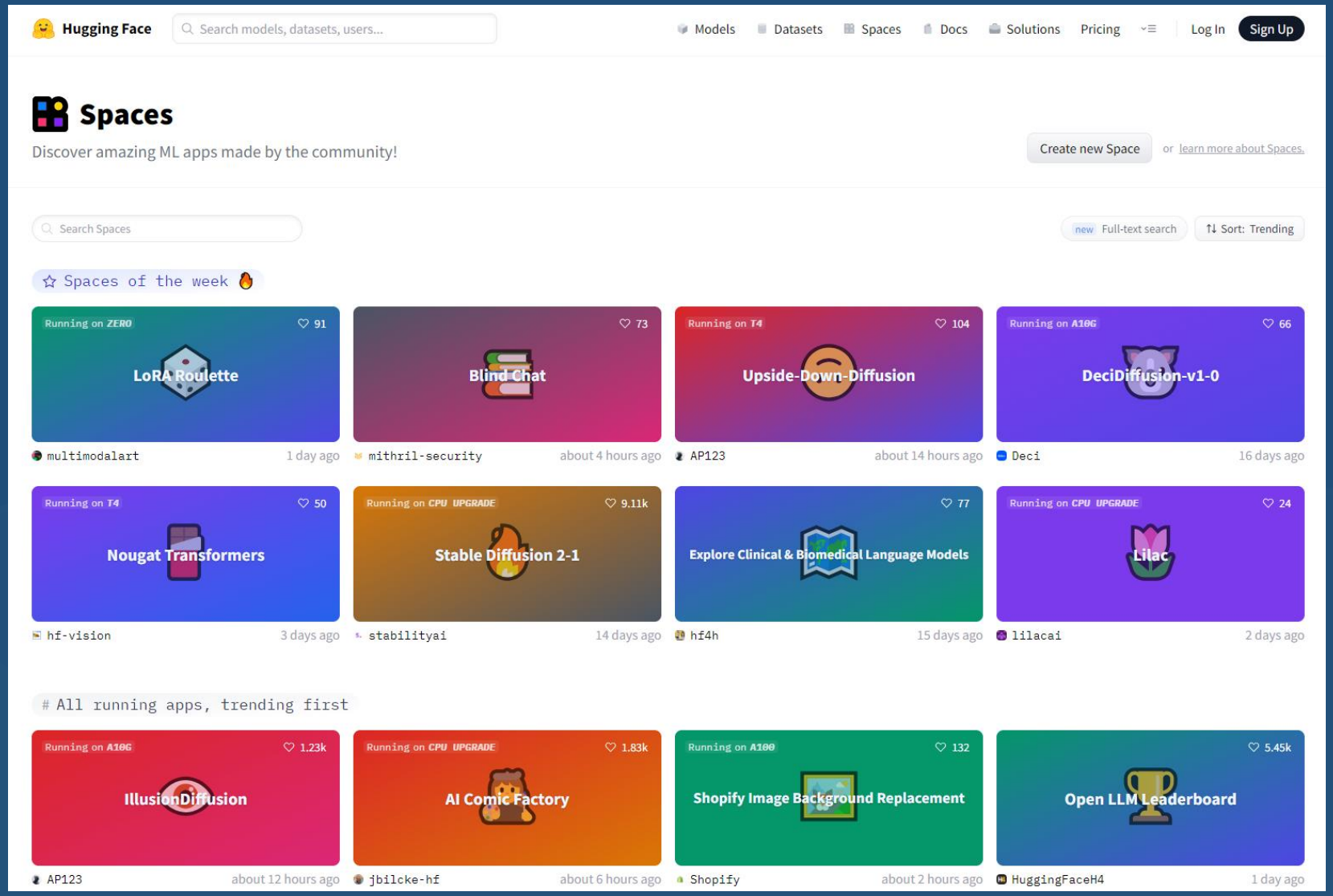
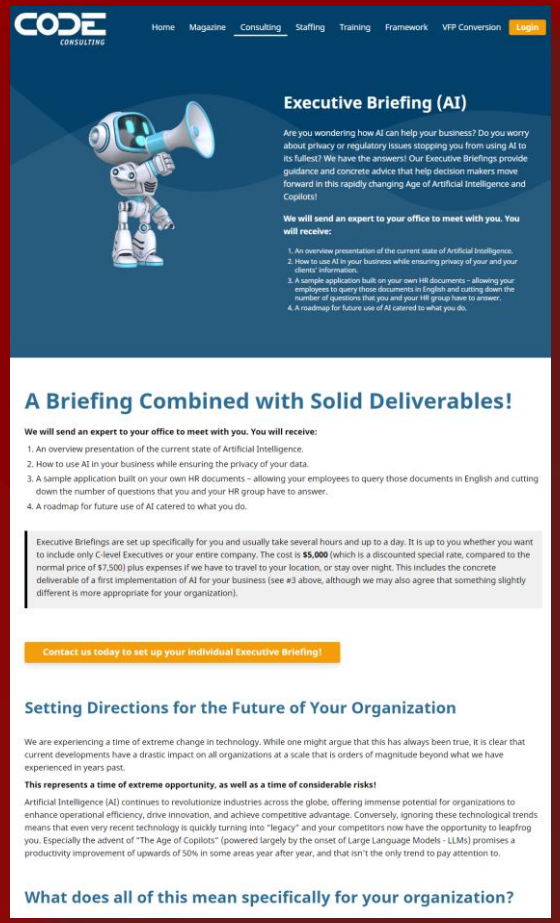
768 × 512
1024 × 768
768 × 1024
1360 × 768
768 × 1360
W 768 px
H 512 px
3:2
Guidance Scale
7
ControlNet
Tiling
Image to Image
Image Prompt
Upload or drag and drop an image to use as input
PNG or JPG up to 5MB
Show Advanced Settings
Reset to defaults

Hugging Face



Other Announcements

AI Consulting Services



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Upcoming CODE Training Classes

- Public AI Training Classes
  - Introduction to Development with Open AI, ChatGPT, Azure Open AI, and more...
  - Building Copilots for your own apps
- Classes are also available as individualized private classes and mentoring sessions

https://www.codemag.com/training

Upcoming Events

- State of .NET Online - .NET 8 – November
- https://www.codemag.com/StateOfDotNet

- CODE Presents – Monthly – Mostly AI
- https://www.codemag.com/CODEPresents

Recordings & Slide Decks

- State of .NET Webinar Series
  - codemag.com/StateOfDotNet
- CODE Presents Webinar Series
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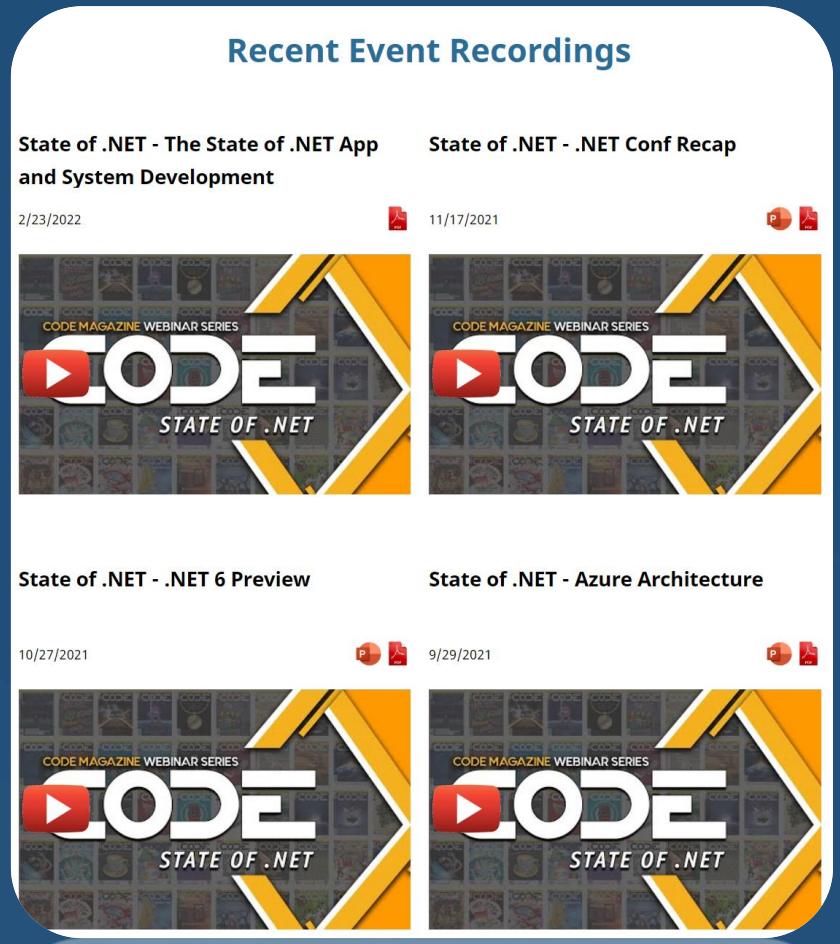

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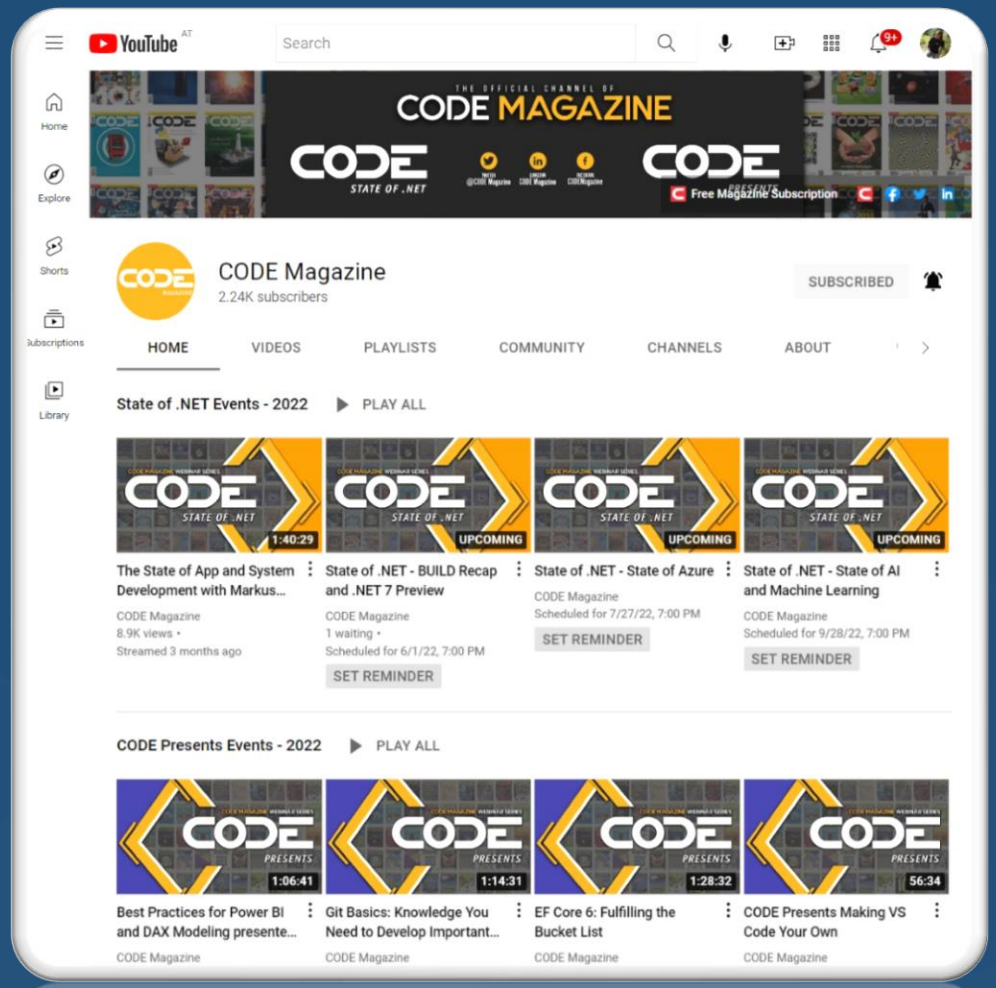

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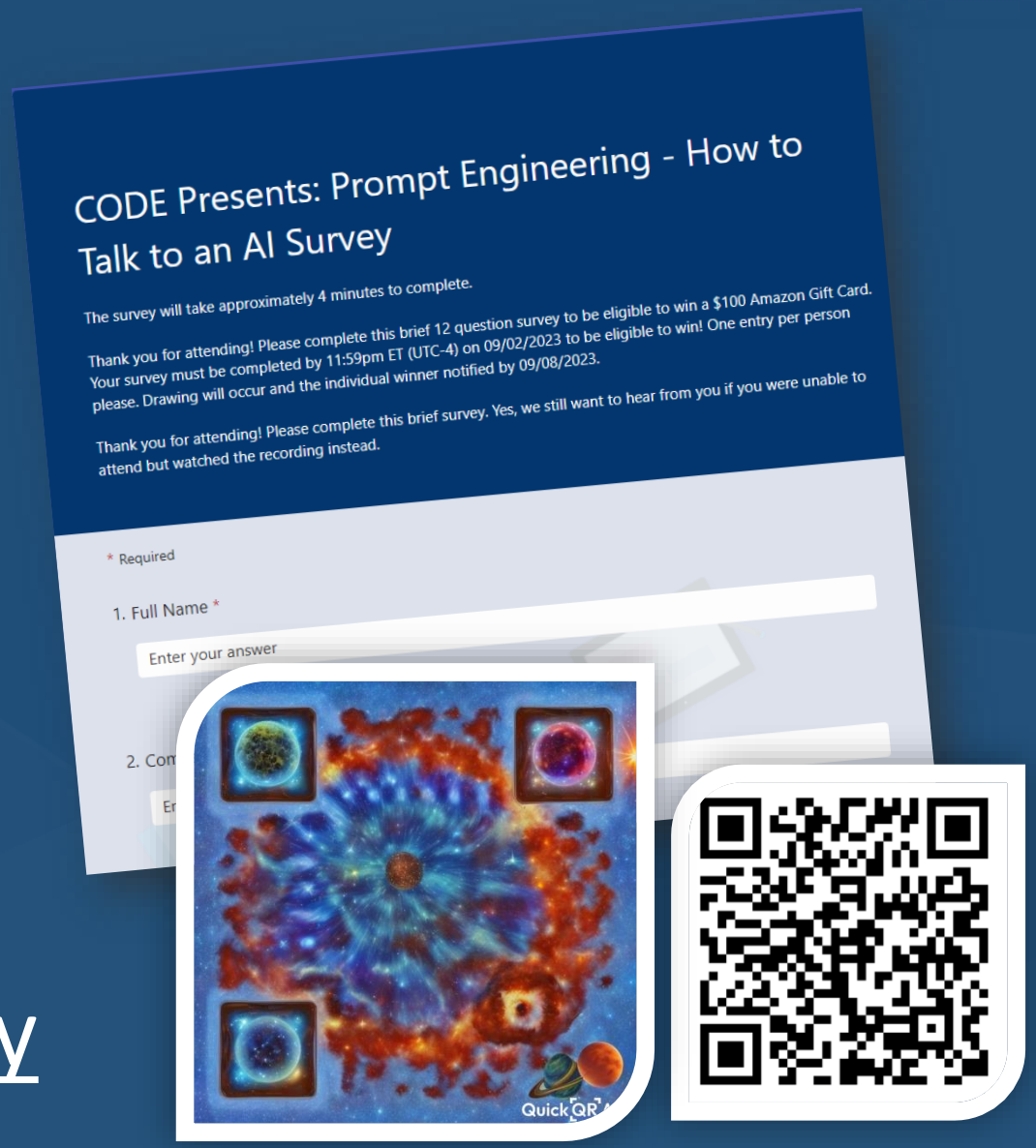

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Q&A

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