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LEARN HOW IMAGE GENERATION WORKS IN 2 MINUTES

An introduction to diffusion models

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Introduction

Image generation involves creating new images from scratch using various algorithms and models, often driven by artificial intelligence (AI) and machine learning (ML). It has a wide range of applications, from artistic creation to practical uses in design, gaming, and even medical imaging.

Here are a few widely used Image Generation techniques:

- Diffusion Models
- Generative Adversarial Networks (GANs)
- Variational Autoencoders (VAEs)
- Neural Style Transfer
- PixelRNNs and PixelCNNs
- Conditional Image Generation cGANs

Generated by DALL-E

Diffusion Models

These models use a random noise image and a text description to improve the image gradually. By learning to reverse the noise step by step, guided by the semantic information from the text, creating a clear, realistic image that aligns with the provided description.

Key Concepts in Diffusion Models

- **Forward Diffusion Process:** This process adds noise to the data iteratively over a series of steps, creating a noisy image

- **Reverse Diffusion Process:** This process involves learning to remove the noise step by step to recover the original image from the noisy data.
- **Score Function:** In score-based models, the score function represents the gradient of the log probability density of the data. It is used to guide the reverse diffusion process.

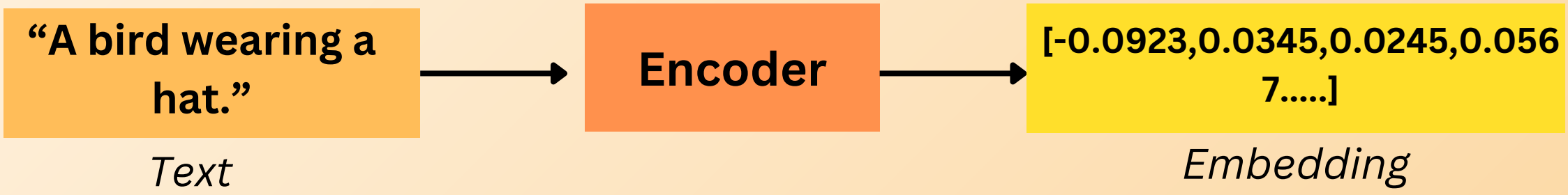
Step-wise Image Generation

Step 1: Initialize with Text
Start with a detailed text description of the desired image

Step 2: Convert text to Embeddings
Use a language model to convert the text description into a set of numerical embeddings. These embeddings capture the semantic meaning of the text.

Step 3: Generate initial noise Image
Create an initial image filled with random noise. This serves as the starting point for the generation process.

Step 4: Condition the model
Integrate the text embeddings into the diffusion model. This conditioning helps the model understand how to transform the noise image according to the text description.

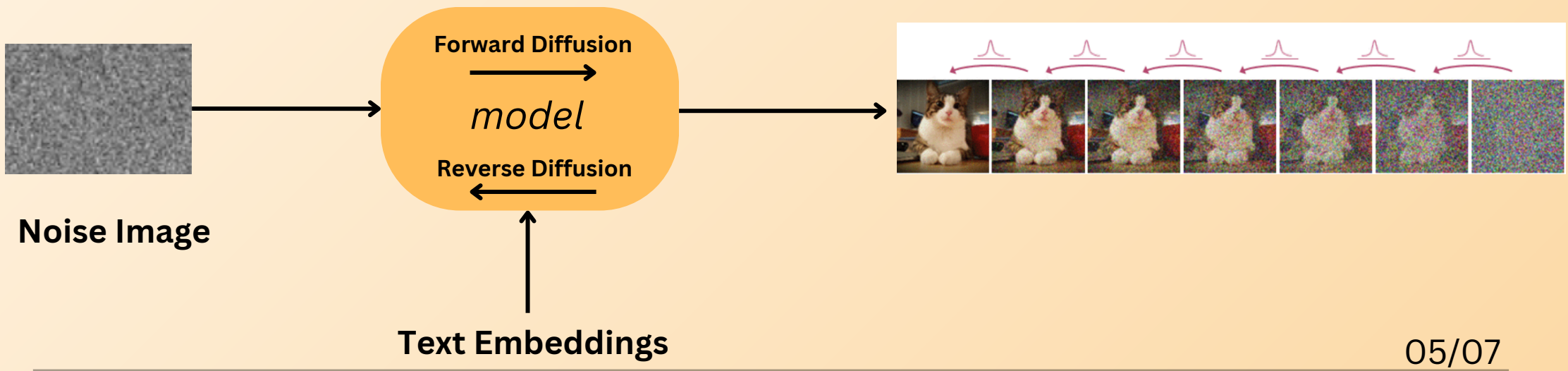


Step-wise Image Generation

Step 5: Adding Gaussian noise
The model adds Gaussian noise iteratively in the reverse direction during training, helping it learn how to denoise images.

Step 6: Reverse Diffusion
Once trained, the model starts with the noisy image and begins the reverse diffusion process. It progressively reduces noise, refining the image at each step to match the text description.

Step 7: Iterative Refinement
The model undergoes several iterations of noise reduction. With each pass it refines the image further, making it clearer and more aligned with the text description leading to a high-quality output image.



What do you think about the ethical implications of AI-generated images?

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