Dynamic Autostereograms - Powered by DALL-E

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Introduction:

This project aims to create customizable and unique autostereograms—those "Magic-Eye" pictures where a hidden 3D image appears when you focus your eyes just right. Instead of using fixed patterns like traditional autostereograms, we'll be using DALL-E to generate both the hidden 3D image and the repeating pattern based on the user prompts. By integrating generative AI we want to make these optical illusions more visually interesting, personalized, and fun to look at.

Approach:

The following is my approach:

1. **Image Generation with DALL-E:**
   We will provide users with an interface to enter two prompts. Using OpenAI's DALL-E API, we will generate the source image and pattern image based on the provided prompts. Prompt 1 will be used to generate the Source Image, representing the object or scene for which the depth map will be created. Prompt 2 will generate the Pattern Image, which will serve as the repeating texture in the autostereogram, concealing the hidden 3D content.
2. **Depth Map Generation:**
   The generated source image is processed using MiDaS, a cutting-edge depth estimation model, to produce a depth map. In this depth map, each pixel is assigned a relative depth value, indicating its perceived distance from the viewer. Typically, lighter regions correspond to objects that appear closer, while darker regions represent those that are farther away.
3. **Pattern Reconstruction:**
   The patternReconstruction function will create a pattern image that matches the size of the depth map, allowing us to control how many times the pattern repeats to form seamless tiles. This tiled pattern will cover the entire image smoothly, aligning with the depth map.
4. **Autostereogram Generation:**
   The final step combines the depth map and repeating pattern to create the autostereogram. The generateAutoStereogram function adjusts the horizontal displacement of pattern elements according to depth values, producing the intended 3D effect. The final autostereogram is a blend of the repeating pattern and the hidden image. When viewed with the right focus, the hidden 3D image emerges from the pattern, revealing itself to the viewer.

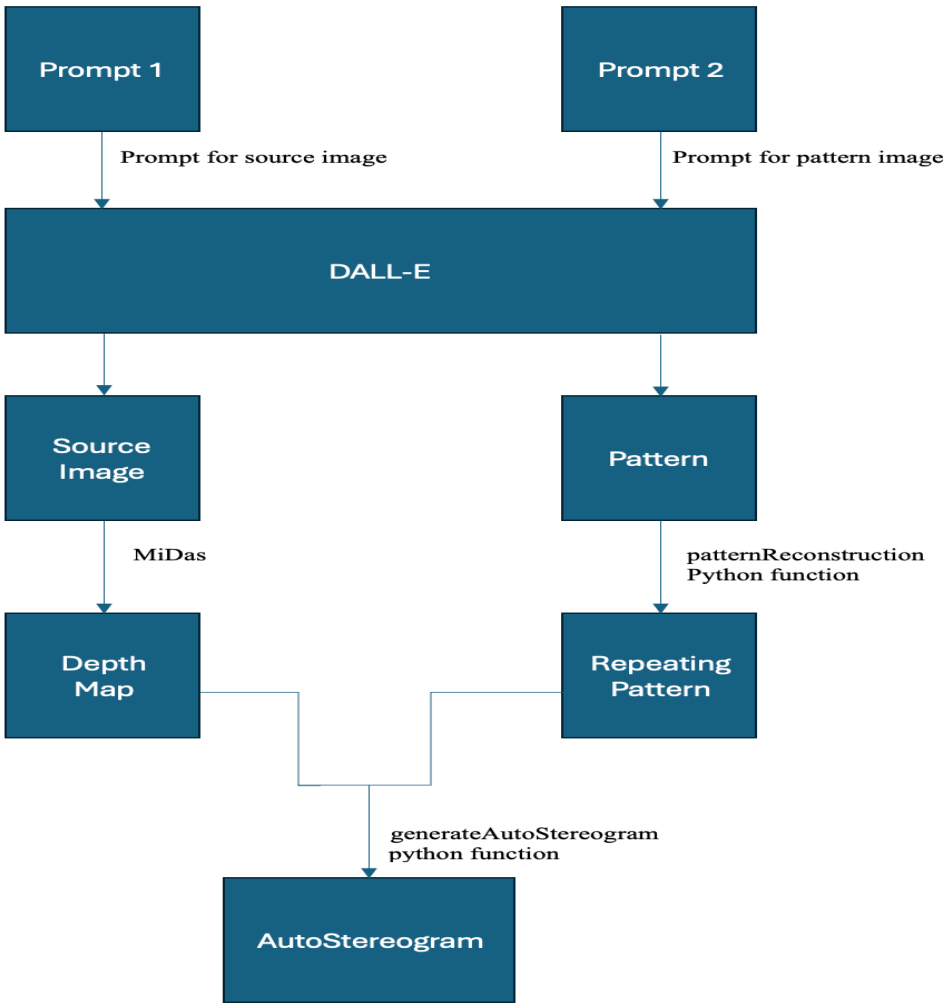

Figure 1 Flow Diagram

Input Data:

1. **Two Text Prompts:**
   1.1. **Prompt 1:** Text description for the source image (e.g., "Cat").
   1.2. **Prompt 2:** Text description for the pattern image (e.g., "a repeating pattern of a mouse").
2. **Generated Images:**
   2.1. Source image from DALL-E based on Prompt 1.
   2.2. Pattern image from DALL-E based on Prompt 2.

Output Data:

An autostereogram image, where the hidden image (based on Prompt 1) is embedded within a repeating pattern (based on Prompt 2), generated with depth cues that enable a 3D viewing experience.

Training Data:

Since we will be using only pre-trained models, no training data is required for this project. Here's an overview of the models being used:

- **DALL-E:** A generative model developed by OpenAI that can create images from text prompts. This will allow us to generate the hidden 3D images and repeating patterns for the autostereograms based on user inputs, providing high levels of customization.
- **MiDaS:** A depth estimation model developed by PyTorch. MiDaS generates depth maps from a single 2D image, which will be used to define the 3D structure in the autostereograms. The model is pre-trained on a wide variety of data, ensuring accurate depth prediction across different image types.

Evaluation Plan:

The success of this project will be evaluated based on:

- **Visual Quality:** The clarity and aesthetics of the autostereogram. Viewers should be able to identify the hidden 3D image when focusing correctly.
- **Depth Perception:** Effectiveness of the depth map in creating a convincing 3D effect. This will be tested with different source images to ensure versatility.
- **User Customization:** The ability to produce varied results based on different prompts. Evaluation will involve generating multiple autostereograms to ensure that the prompts meaningfully impact the outcome.
- **Automated Validation:** The final autostereogram will be uploaded to the MagicEyeSolver website to verify if it successfully conceals and reveals the 3D image as intended. This tool will serve as an additional check for the accuracy and functionality of the generated autostereogram.

Impact

- **Personalized Decor:** People could use custom autostereograms as artwork in their homes or offices. With prompts that match their interests or surroundings, these pieces could add a playful touch to any room, where guests can engage with hidden 3D images embedded in the patterns.
- **Mindfulness and Focus Exercises:** Autostereograms require the viewer to focus and relax their gaze, which can help with mindfulness and stress relief. Creating personalized autostereograms could turn this into a fun daily exercise to help you relax and improve focus.

- **Therapeutic Uses**: Autostereograms are already used in vision therapy to improve eye coordination, focus, and depth perception. By allowing users to create personalized autostereograms, this project can make these therapeutic exercises more engaging and tailored to individual preferences, which could improve their effectiveness and make the process more enjoyable.