EE367 Project Proposal

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1 Motivation

Art is inherently visual. With the advances of computational imaging, one is able to explore the possibilities of allowing the public to interact with art in ways that would be otherwise impossible. For example, an engineered t-rex paper craft, as shown in Figure 1, can produce an optical illusion that the observer feels that the t-rex is always looking at him or her. To fulfill this goal, this project aims to designing a system that can crop human faces from photos and map it on a template that can create an optical illusion effect which lets the image seem to turn its head and follow you as you move.

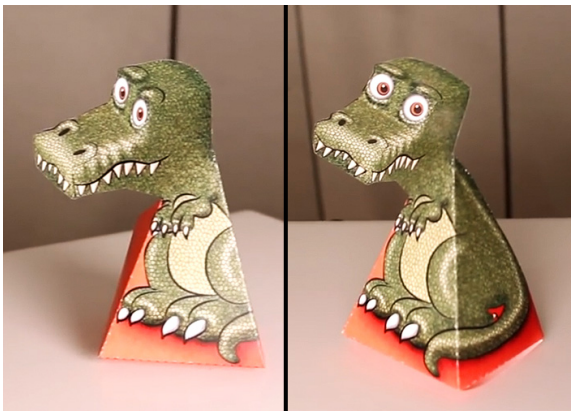

Figure 1: Example of an optical illusion t-rex. (Source)

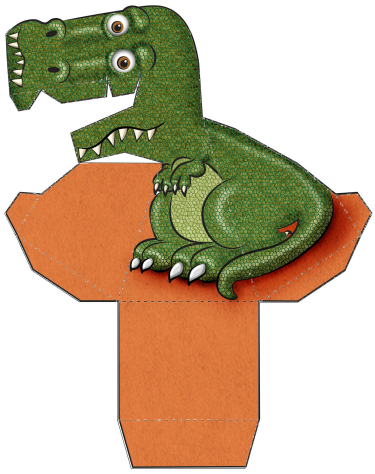

Figure 2: Printout of the template (Source)

2 Related work

Cropping human face from one image and mapping it on another template is not a new concept, such as [1] uses one's facial expression as a template, then crop and wrap another person's face to map on it. Also, it's not difficult to find a lot of optical illusion paper craft template on the Internet; for example, this YouTube video showcases the most common instance, a t-rex always gazing at you.

3 Project overview

I will be designing a system that can create a human-face illusion product, which seems to turn its head and follow you as you move, by capturing human faces from photos and geometrically transforming it onto a template that tricks our brains to interpret faces as convex.

4 Outlook

4.1 Milestone

4.1.1 OpenCV

OpenCV [2] is an open source computer vision and machine learning software library which has been widely utilized to provide a common infrastructure for computer vision applications. As this project employs OpenCV for a great portion of the image processing pipeline, I will be working on the environment setting and studying the usages of the functions required for this project.

4.1.2 Face recognition

The final product must be able to locate the face in the image and return a bounding rectangle/square that contains the face, so that system can accurately crop the human face from the photo. Also, the system needs to find the location of different facial features (e.g. corners of the eyes, eyebrows, mouth, and the tip of the nose). As a result, face recognition [3][4] will be a core part of the pipeline, which will be implemented by using OpenCV.

4.1.3 Perspective transformation

Perspective transformation can be used to scale and perspective-distort an image so it fits perfectly into a specific frame. Therefore, system can use the facial features found from the previous section as landmarks and apply perspective transformation technique to correctly map the human face on the template.

4.2 Time line

Week	Progress
Feb 20	OpenCV
Feb 27	Face recognition
Mar 06	Perspective transformation
Mar 13	Final product
Mar 15	Poster and report

4.3 Goal

The goal of this project is to implement a system that can generate a real optical illusion product from a photo. The basic function of the system is to capture the human face from a photo and correctly transform it onto the template. The final product will be a 2-D layout, as shown in Figure 2, that can be printed out for further assembling.

References

[1] P. Garrido, L. Valgaerts, O. Rehmsen, and T. Thormählen, "Automatic Face Reenactment," CVPR 2014.

[2] G. Bradski, "openCV," Dr. Dobb's Journal of Software Tools (2000).

[3] R. Brunelli and T. Poggio, "Face Recognition: Features versus Templates", IEEE Trans. on PAMI, 10 ,1042–1052 (1993).

[4] Z. Cao, Q. Yin, X. Tang, and J. Sun, "Face Recognition with Learning-based Descriptor," CVPR 2010.