Edge-Guided Image Inpainting: Project Proposal

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1.

Image inpainting is a task of filling in missing regions of an image. Typical image inpainting focuses on filling in a particular region automatically, while users do not have control over the entire infilling process. However, the main purpose for using image inpainting techniques these days should be removing certain objects from the image instead of solely fulfilling the missing area of the image. In these cases, the missing regions of the image would often have small areas and irregular shapes. Our project aims to fill in these kinds of holes in the image. Given an image with a free form region erased, our goal is to first provide the user with an edge map generated by our algorithm as a recommendation and guidance for inpainting. Meanwhile users can modify the recommended edge guidance. The final step of the algorithm will take the edge map and generate the final inpainted result.

2.

- Edge detection (used for finding edges of the unmasked area and taking it as one of the priors for inpainting).
- Keypoints matching (used for matching the coarse infilled patches to patches in the unmasked areas to do the final refinement of the result).
- Deep learning (used for generating faithful inpainting result as deep learning have better performance over traditional algorithms in most cases)

3.

One of the major traditional methods is patch based approach. This method patches missing areas with background image by maximizing patch similarity. However, it has the assumption that the texture of impainted area can be found in the background.[5] Recently, there are more deep learning approaches in image inpainting. These methods are capable of reconstructing coherent structures for the missing holes in the image by learning data distribution. However, the results sometimes lack high frequency information, which creates artifacts or blurriness around the border.[1]

4.

We will take the algorithm presented in paper EdgeConnect[1] as a starting point as it provides us with a good framework for doing the job we want. We want to implement the algorithm used for predicting missing edges in the masked area in the first place. We want to try out several neural network architectures for this part along with the ResNet

presented in [1]. For example, the idea of Gated Convolution[2] seems to have better performance on masked-image type of problems.
After getting the predicted edges of the masked area, users can modify the predicted edges to better fit their demand. We will then work on the algorithm to reconstruct the color of the masked area with the help of the edge map we get from the first step. We assume that the result we get from this step will be an inferior one, as many papers are presenting a final refinement step ([2],[3],[4]). In this case, we may also add a final refinement step if the result we get from the previous step does not reach our satisfaction. For this part, the algorithm presented in [3] seems to be attractive to us as it is using patches from the original image to do the refinement, and we think this algorithm might be able to preserve the detailed texture of the image inside the infilled area.

5.

- Set up a github repository and discuss what algorithm or method to implement
- Implement algorithms that related to edge generation and image inpainting completion
- Select some examples that may lead to successful or failure results, do comparison and improve our code implementation
- Organize code and try to improve the speed and accuracy of our algorithm
- Prepare report, recorded video presentation and oral defense with the final result

References:

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[5] Rajesh Pandurang Borole, and Sanjiv Vedu Bonde. “Patch-Based Inpainting for Object Removal and Region Filling in Images”. Journal of Intelligent Systems, Volume 22: Issue 3. ***https://doi.org/10.1515/jisys-2013-0031***