P3-13

# Ramen Spoon Eraser : CNN-based photo transformation for improving attractiveness of ramen photos

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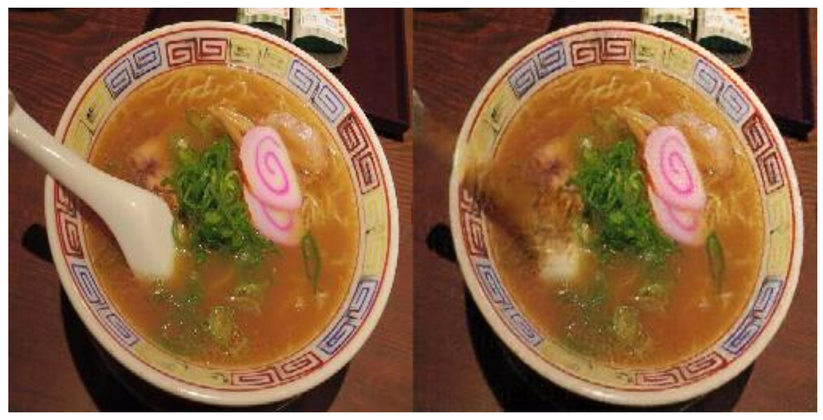
## Introduction

- A ramen spoon in a bowl spoils its appearance greatly as shown in the right figure.
- To improve attractiveness of ramen photos, erasing ramen spoon is indispensable.
- High-quality image transformation is possible with GAN-based image-to-image transformation (Pix2pix) [3], which potentially erases ramen spoons from photos.



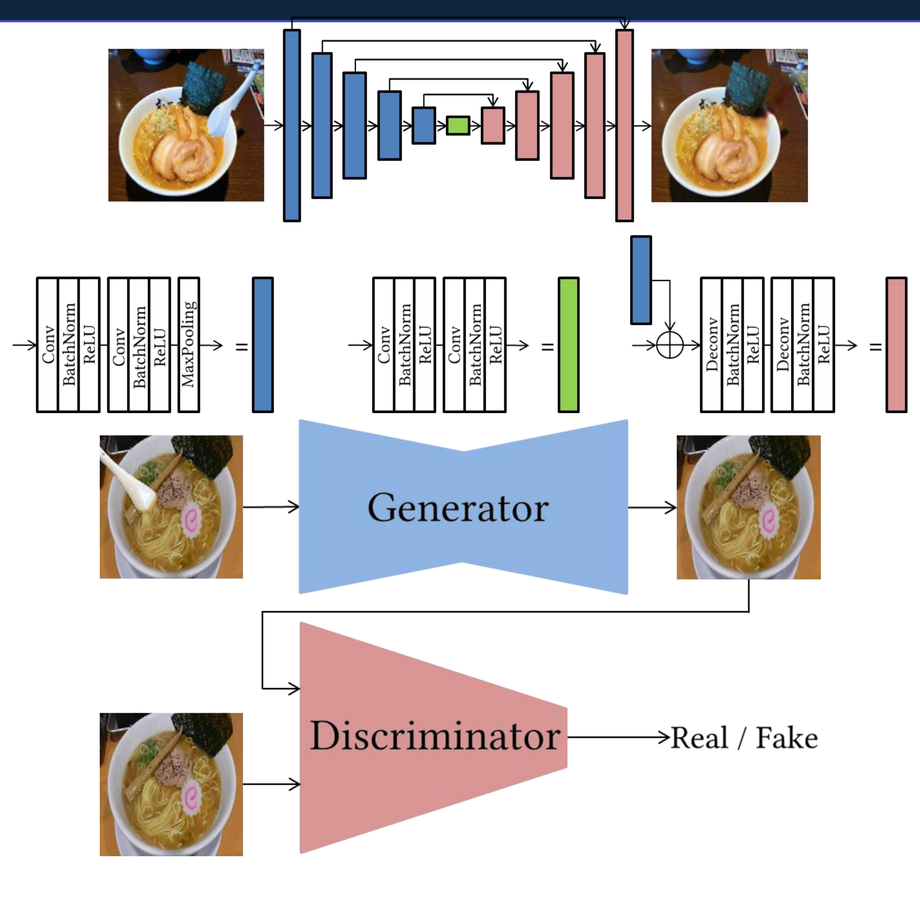
## Proposed Method

- We adopt a U-Net[2] as a image transformation network.
- We train it in two ways: MSE loss and Pix2pix loss[3]
- Mean Squared Error (MSE) Loss

$$\ell(x, y) = L = \{l_1, \ldots, l_N\}^\top, \quad l_n = \left(x_n - y_n\right)^2,$$

- Pix2pix [3] (with adversarial training)

$$\begin{aligned}
\mathcal{L}_{cGAN}(G, D) &= \mathbb{E}_{x,y}\left[\log D(x, y)\right] + \\
&\quad \mathbb{E}_{x,y}\left[\log\left(1 - D(x, G(x, z))\right)\right]. \\
\mathcal{L}_{L_1}(G) &= \mathbb{E}_{x,y,z}\left[\|y - G(x, z)\|_1\right]. \\
G^* &= \arg\min_G \max_D \mathcal{L}_{GAN}(G, D) + \lambda \mathcal{L}_{L_1}(G).
\end{aligned}$$




## Experimental Results

- [Training data] 6000 pairs of ramen-without/with-spoon photos
  - We generated ramen-with-spoon photos by overlaying ramen spoon images on the ramen-without-spoon photos randomly.
- We trained two model using the MSE loss and the Pix2pix loss.
- We compare two models :
  - **MSE loss** erased spoons. However, the results are blurred.
  - **Pix2pix** erased spoons more naturally than MSE loss.
- In the third row, both models failed to remove spoons, because the training data did not contain enough images with red ramen spoons.
- We have not evaluated which one seems to be more attractive by subjects.
  - So, we would like you to attach a sticker to more attractive images !!


| MSE Loss | Pix2pix |
|---|---|
| | |

## Conclusions

- We proposed an application which erases a spoon from a ramen-with-spoon photo by CNN-based image transformation.
- We plan to extend our model for diverse utensils such as chopsticks, forks and knives to make food photos more attractive.

[1] I. Goodfellow, J. Pouget-Abadie, M. Mirza, B. Xu, D. Warde-Farley, S. Ozair, A. Courville, and Y. Bengio. Generative adversarial nets. In Advances in Neural Information Processing Systems (NIPS), pp.2672–2680. 2014.
[2] O. Ronneberger, P. Pischer and T. Brox. U-Net: Convolutional Networks for Biomedical Image Segmentaion. In Proceedings of the International Conference on Learning Representation(ICLR), 2015.
[3] P. Isola, J.-Y. Zhu, T. Zhou, and A. A. Efros. Image-to-image translation with conditional adversarial networks. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017.