Image inpainting with Deep Learning

ECE 228 Final project presentation

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Background

How to deal with photo and image with flaw?

Background

1. Image inpainting reconstruct missing/damaging part of images and photos.
2. Used to remove unwanted objects from an image
3. It is conducted by deep learning (GAN).

Traditional Approach vs DL approach

Traditional Approach Computer Vision:

1. Diffusion:
    a. Propagate local structure into unknown part.
2. Exemplar:
    a. Construct the missing part pixel with neighboring pixels.

DL Approach:

1. Data driven deep learning-based inpainting.
2. When trained a huge datasets, deep network have remarkable performance.

Literature survey

ML solution:

1. Generartive Adversarial Network (GAN)
2. AutoEncoders (AE) framework are generative modeling literature in the past ten years.
3. Discriminator Network provides scores to generator.
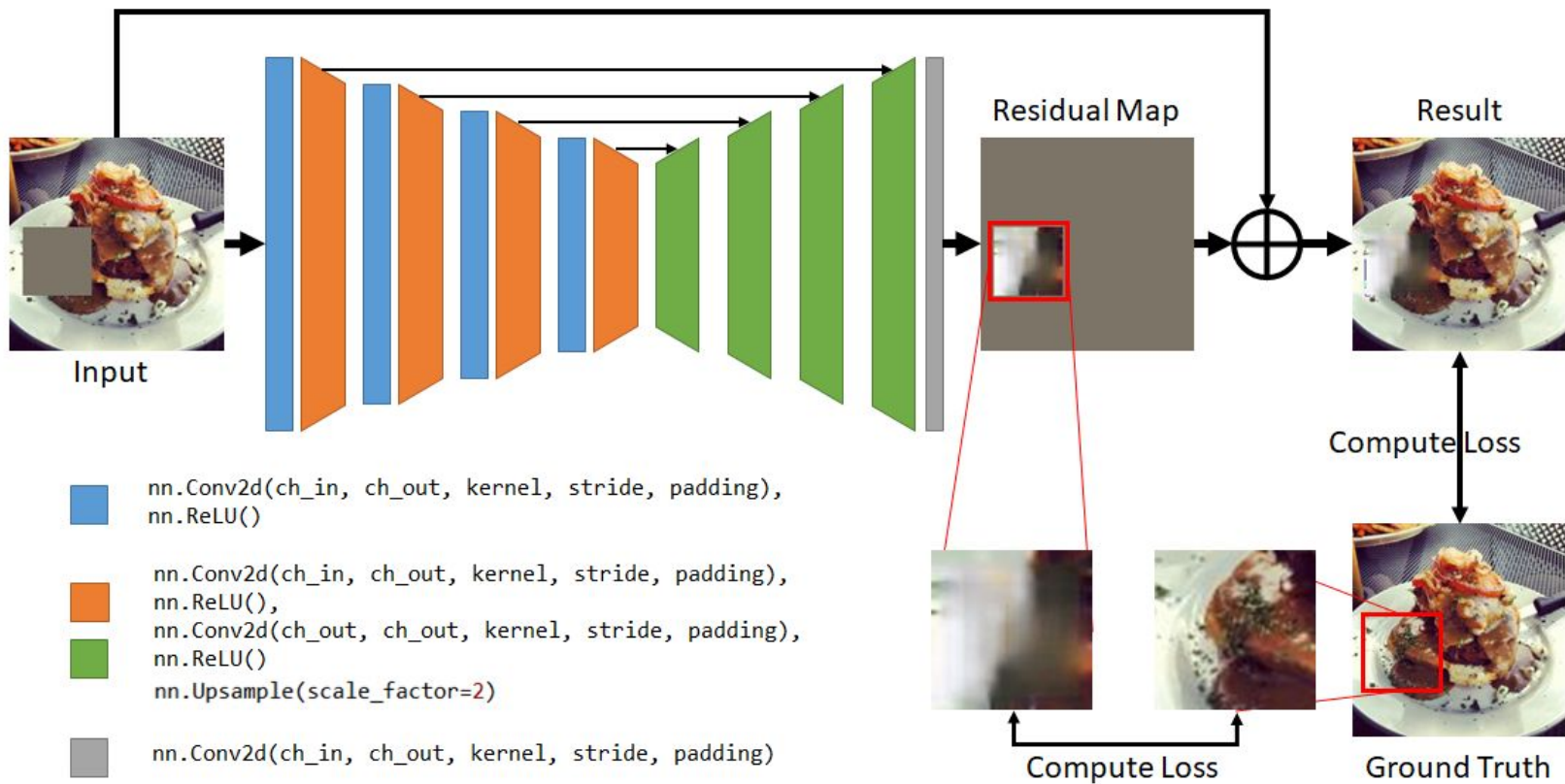
GAN steps:

1. Select a number of real images from the training set.
2. Generate a number of images using generator.
3. Train the discriminator for one or more epochs using both fake and real images.
4. Generate another number of fake images.
5. Train the full GAN model for one or more epochs using only fake images.

Dataset - Microsoft COCO

- COCO (Common Objects in Context) is a object detection, segmentation, and captioning dataset.
- Generate patches to cover part of the images
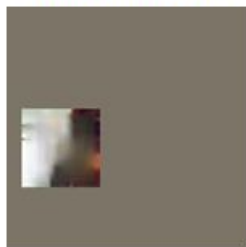- 118k training instances
- Large category coverage

Dataset examples

Residual Map

Result

Compute Loss

Compute Loss

Ground Truth

Input

```
nn.Conv2d(ch_in, ch_out, kernel, stride, padding),
nn.ReLU()

nn.Conv2d(ch_in, ch_out, kernel, stride, padding),
nn.ReLU(),
nn.Conv2d(ch_out, ch_out, kernel, stride, padding),
nn.ReLU()
nn.Upsample(scale_factor=2)

nn.Conv2d(ch_in, ch_out, kernel, stride, padding)
```
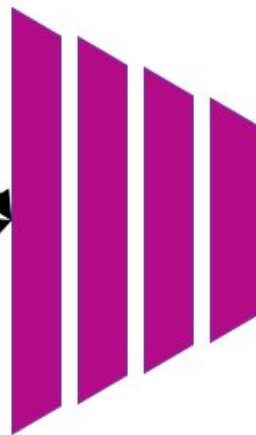
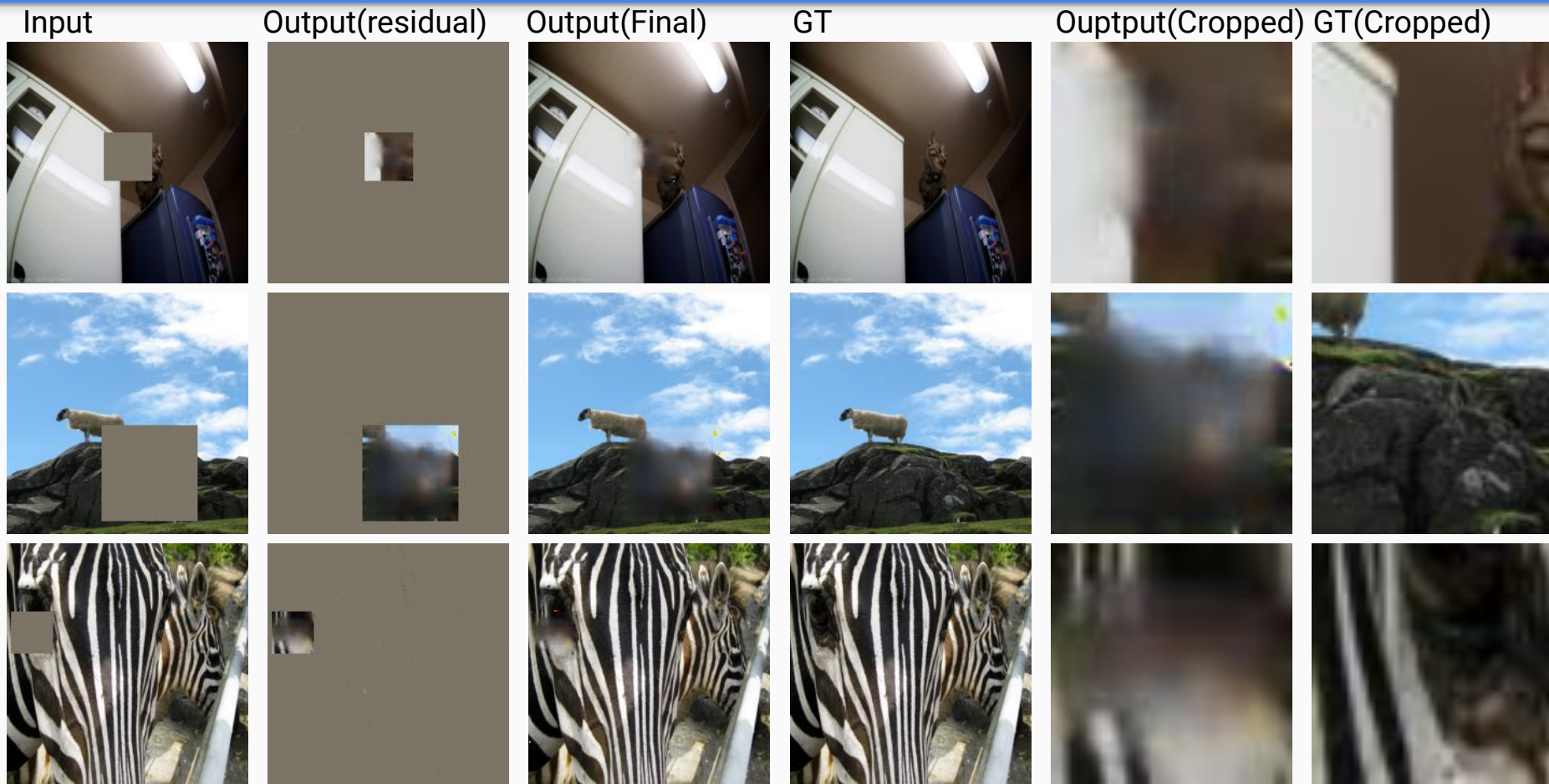Generator's Input   Residual Map   Generator's Result

Ground Truth

Real? Fake?

```
x = self.LeakyReLU(x)
x = self.conv2d(x, ch_in, ch_out, kernel, stride)
x = self.BatchNorm(x)
```

Result and Observation

| Input | Output(residual) | Output(Final) | GT | Ouptput(Cropped) | GT(Cropped) |

Future Work

- Keep training

  The model now is train on a smaller dataset. Therefore, we plan to train on the full COCO dataset to get a fully seen of our model.

- Try another model or method for easier training

  Now our model can only train with batch size = 1. Hence, we would like to find another smaller model to resolve the task.