Do super-resolution /inpainting methods work for medical applications

Short project name: Super-res/Inpainting

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Project Motivation: Use bayesian image reconstruction to inpaint partial images and use super-resolution to increase the quality of low quality images. We would assess how this tool would help specialists to gain higher resolution images to better diagnose and understand a patient, and to give a specialist the ability to widen the scope of a current image, possibly giving additional image information. Trying to see if these methods are useful and accurate for medical applications leads to our research and to further understand the subjects medical condition.

Overview

1.1 General Project Goals

In this project, we will analyze how super-resolution and inpainting work for medical application . The techniques include bayesian image reconstruction, implanting artificial tumors, reducing resolutions and blacking out a region. We will also find ways to prevent errors and try to generate accurate results for patient diagnosis.

1.2 Project Steps

Step 1: We will find the resources about super-resolution and learn that.
Step 2: We will learn how the super-resolution method is applied to medical applications. Gain an understanding of its implementation in synthesising human anatomy.
Step 3: We will search what methods and algorithms can be used to implement the super-resolution.
Step 4: We will try to implement the program and test the program.
Step 5: We will try to use the program to solve some medical problems.
Step 6: We will record the results and analysis to make a report.

1.3 Timeline

Week 1: Searching resources related to super-resolution and inpainting and learning how they are applied in medical applications.

Week 2: Implementing super-resolution microscopy and bayesian image reconstruction algorithms on the images. Improving the efficiency and correctness
Week 3-4: Recoding important and meaningful results and linking them to the actual medical application.
Week 5-6: Making 2 minutes video and writing the technical detail report.

1.4 Duties

Mattias Stroman: Study base code used to make deep learning algorithms. Write training code for the algorithm as well as finding batch images for training material.
Che Yu Wu: Research and implement the algorithms. Record and observe results.Improve the efficiency and correctness and participate in the report and video creation.
Shaoqiang Zou: Complete part of implementations, test the program, record and analyze the results, write the report, make video.

2 Problems

2.1 Anticipates Problems

We may encounter the problem of algorithm selection, and we will choose the appropriate algorithm based on the data, and if there are multiple algorithms, then we will choose the one with good results.

2.2 Improper In-painting

The algorithm produced may not properly in-paint images we supply it. This problem can undermine our goal of providing additional information for diagnosticians by placing erroneous information into images.

3 Materials

3.1 Data

Medical images and photos of faces used to train the algorithm. These need to be taken in large enough batches to give the algorithm the ability to learn from them.

3.2 Software

Python will be the language used to write the learning code for the algorithm. TensorFlow will be the machine learning library used. Numpy and Anaconda3 will also be used.

3.3 Algorithms

-STED, -Bayesian image

4 Results

4.1 Detailed Anticipated Results

Create a deep learning algorithm that can add accurate resolution to an image. Testing based on original vs outputted. Accurately inpaint images that are similar to images used to train the algorithm. The expected ability will be for medical diagnoses allowing users to inpaint possible tumors. This in-painting will be tested to have a high accuracy rate and to not allow false information to be drawn into images.

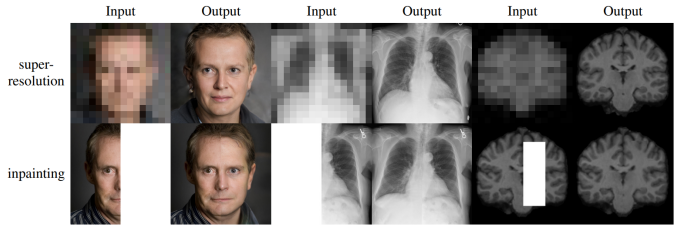

figure 1: Recreate similar results made by Razvan Marinescu, Daniel Moyer, Polina Golland from MIT [https://razvanmarinescu.github.io/brgm/]

References

Author, Razvan Marinescu, Daniel Moyer, Polina Golland.: Bayesian Image Reconstruction using Deep Generative Models. 2(5), https://razvanmarinescu.github.io/brgm/ (2020).