DrewAlderfer / screw_anomaly_detection Public

Phase4 Final Project - Detecting Anomalies in Images of Screws - MVTec DataSet

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DrewAlderfer adding final files … 1 minute ago 9

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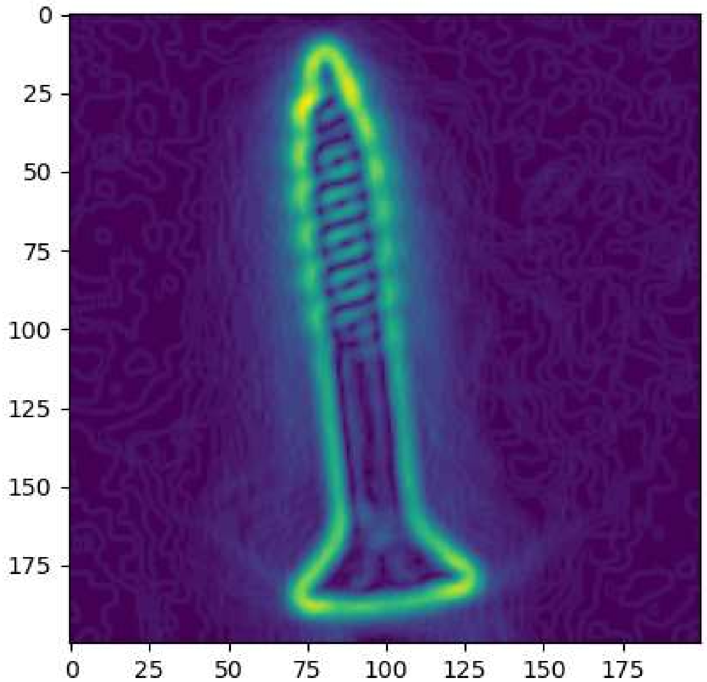
README.md

Anomaly Detection with Autoencoders

Phase 4 Data Science Project by Andrew Alderfer



Introduction

This is the github repo for my project on Anomaly Detection. I used a dataset of some ~500 images of screws to train a neural network and identify anomalous (damaged) screws in the test set.

Follow along below as I breifly run through the project.

Business Understanding

The purpose of this project is to look for ways to improve or automate quality control procedures in industrial manufacturing. The idea is to train a model to identify damaged or faulty products, in this case screws, and remove them from the production line.

Data Understanding

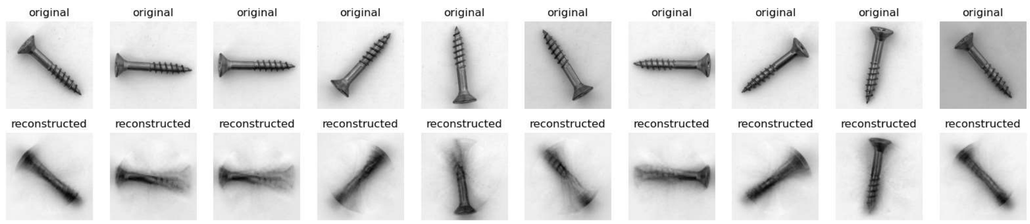
The dataset for this project was graciously provided by MVTec as part of their Anomaly Detection image set.

Data

The data is split into a training and test set, and sub categories within the test set representing the anomalous category of the image. This made it fairly easy to load up the data into a notebook and get going with various autoencoding strategies.

Modeling

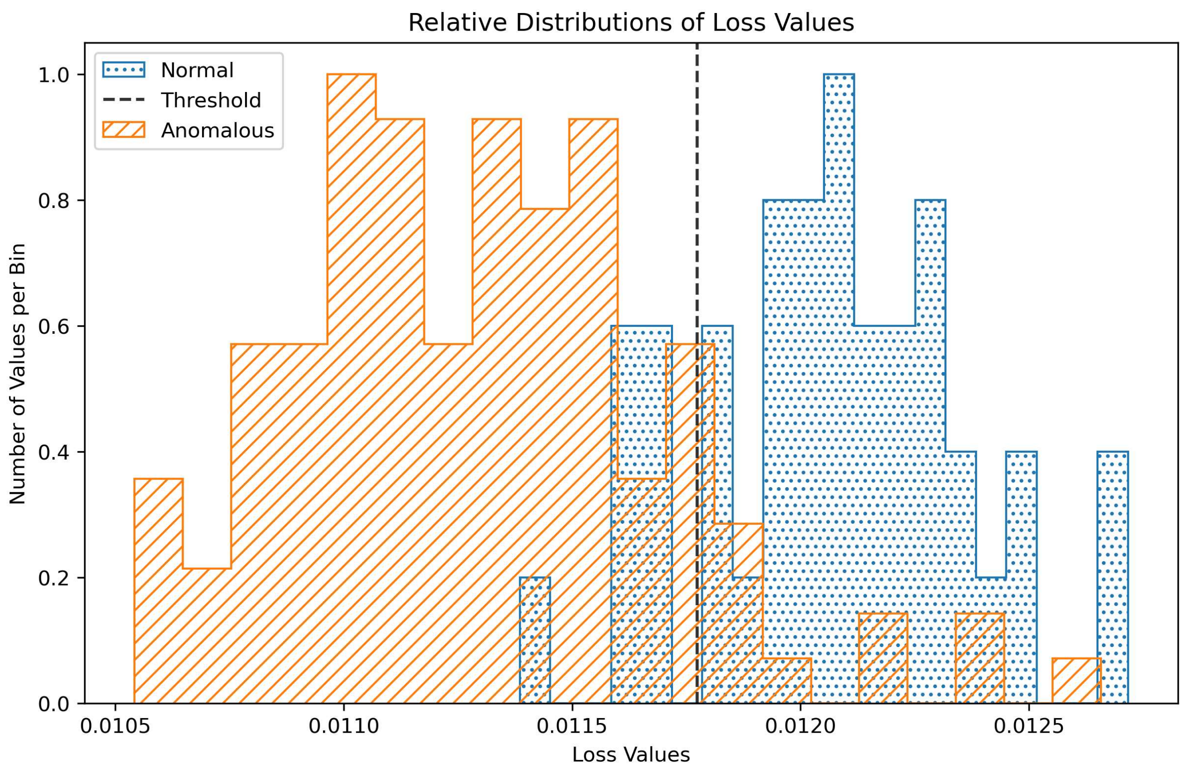
A visualization of the output from my first model is pictured below:



The first model was a simple autoencoder with a series of Dense layers that compressed the data from each image into a relatively tiny tensor and then attempted to reconstruct the original image from that compressed version. As you can see from the image above the model had difficulty abstracting the position of the screw in each image so the output images are blurry and distorted around the center point of the screws.

Final Model

The final model ended up being a multilayered convolutional network. The layers did a better job of abstracting the orientation of the screw and its structure in the image.

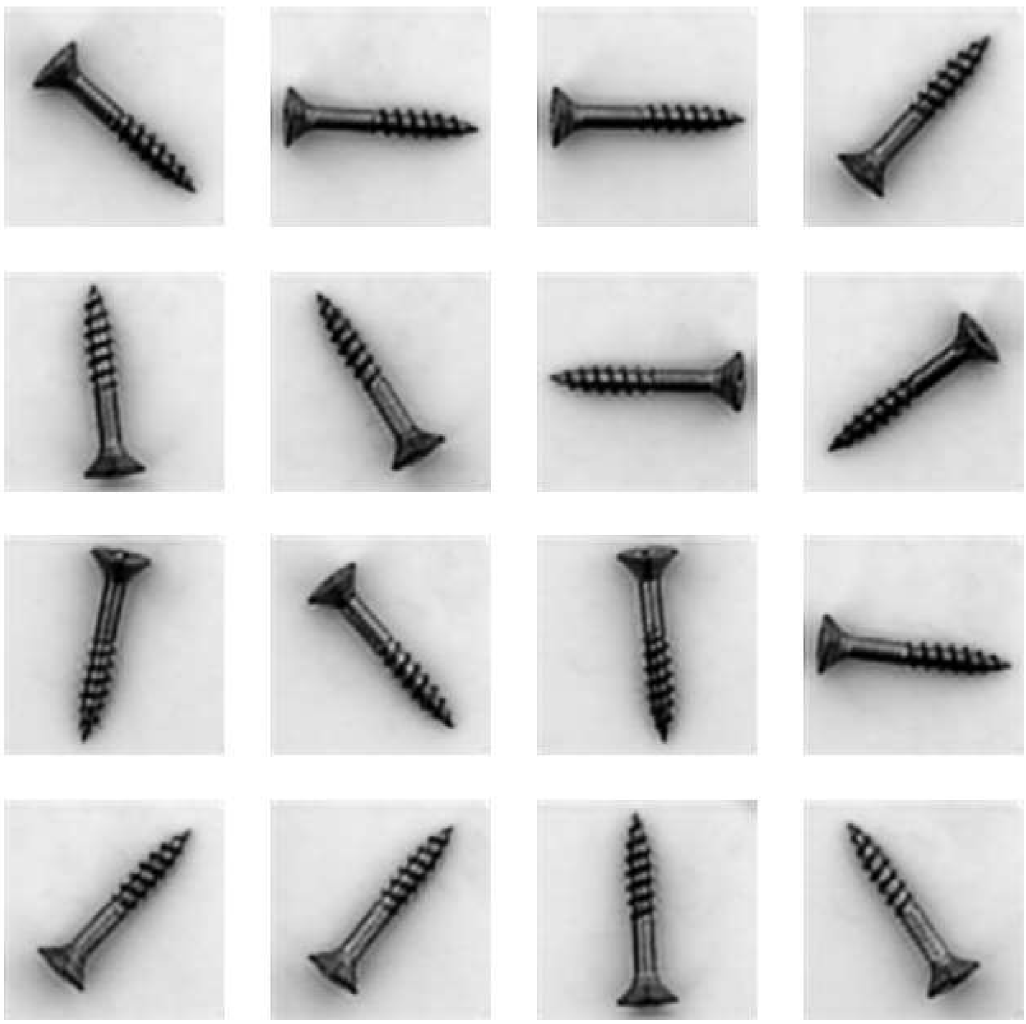


With this model I was able to achieve an average accuracy rating of 86% when it came to classifing anomalous screws. As you can see from the graph above once the model is trained I used the test set to measure the mean-square-error between the models inputs and outputs. This resulted in two loss distributions. A non-anomalous (normal) loss distribution and a loss distribution for anomalous input data.

Using these distributions I calculated a classificatoin threshold and then programmed a function to return the accuaracy rating of that threshold.

Moving Forward

I am continuing to investigate ways of improving this process's accuracy and consistency. I am going to try different loss functions and see if applying different preprocessing methods like sobel filtering or other simple convolutional functions could improve performance, and focus the model on specific features.



Output Images from the Final Model

```
├── data
│   ├── metal_nut
│   │   ├── ground_truth
│   │   │   ├── bent
│   │   │   ├── color
│   │   │   ├── flip
```

```
│   │   │   └── scratch
│   │   ├── test
│   │   │   ├── bent
│   │   │   ├── color
│   │   │   ├── flip
│   │   │   ├── good
│   │   │   └── scratch
│   │   └── train
│   │       └── good
│   └── screw
│       ├── ground_truth
│       │   ├── manipulated_front
│       │   ├── scratch_head
│       │   ├── scratch_neck
│       │   ├── thread_side
│       │   └── thread_top
│       ├── test
│       │   ├── good
│       │   ├── manipulated_front
│       │   ├── scratch_head
│       │   ├── scratch_neck
│       │   ├── thread_side
│       │   └── thread_top
│       └── train
│           └── good
├── images
├── models
│   └── conv_model_01
│       ├── assets
│       └── variables
└── util
    ├── func
    │   └── __pycache__
    ├── models
    │   └── __pycache__
    └── __pycache__
```

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