Anomaly Detection

Guo Mingzhao、Huang Jiahao、Shi Xiaoyu、Yu Chunlin、Zhang Tianyi

上海科技大学
ShanghaiTech University

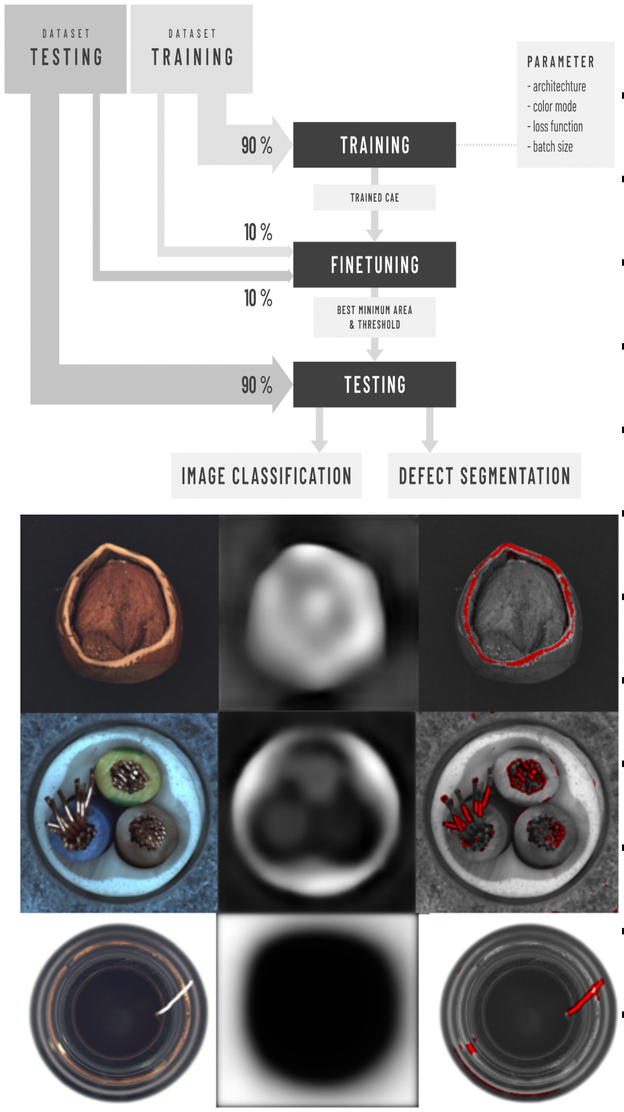
Background

Visual inspection is essential in industrial manufacturing to ensure high production quality and high-cost efficiency by quickly discarding defective parts. Since manual inspection is slow, expensive and error-prone, the use of fully automated computer vision system is becoming increasingly popular.

Methods

There are several methods to detect anomalous objects:

- Autoencoder with SSIM
- Autoencoder with L2
- CNN feature dictionary
- AnoGAN



Category	AE (SSIM)	AE(L2)	AnoGAN	CNN Feature Dictionary
Carpet	0.65	0.33	0.34	0.20
	0.83	0.56	0.54	0.72
Grid	0.82	0.8	0.04	0.02
	0.89	0.87	0.58	0.59
Learner	0.68	0.63	0.34	0.74
	0.75	0.57	0.64	0.87
Tile	0.06	0.28	0.08	0.14
	0.58	0.45	0.50	0.93
wood	0.38	0.26	0.14	0.47
	0.37	0.71	0.62	0.91
bottle	0.01	0.03	0.01	0.13
	0.82	0.85	0.78	0.79
Capsule	0.09	0.16	0.04	0.00
	0.94	0.83	0.84	0.84
Hazelnut	0.00	0.46	0.02	0.00
	0.95	0.91	0.87	0.72
Metal nut	0.01	0.25	0.00	0.13
	0.83	0.81	0.76	0.82
Pill	0.07	0.15	0.17	0.00
	0.9	0.83	0.87	0.68
Screw	0.03	0.34	0.01	0.00
	0.96	0.96	0.80	0.87
Zipper	0.10	0.18	0.01	0.00
	0.87	0.71	0.78	0.76

Results

The Autoencoder classifies the anomalous images and segments the anomalous region. The results are shown above and the anomalous regions are marked in red.

Research Questions

Construct a model to find out the defective product and locate the defective regions.

Conclusion

Autoencoder is a powerful tool for anomaly detection, performing stable training and reasonable reconstructions. But it may lose details for high frequency textures like *tile* and *zipper*, further optimizations need to be made on this.

References

1. MVTec AD — A Comprehensive Real-World Dataset for Unsupervised Anomaly Detection
2. Improving Unsupervised Defect Segmentation by Applying Structural Similarity To Autoencoders