

区別可能な意味情報。第二に、トランスフォーマーの採用により、異常の再構築が適切に行われなため、再構築に失敗すると異常が容易に検出される可能性があります。私たちの方法は、正常なサンプルと異常の間に大きな一般化ギャップをもたらします。さらに、私たちは、画像レベルとピクセルレベルのラベル付き異常を含む異常が利用可能なケースにアプローチを拡張するための新しい損失関数を提案し、性能をさらに向上させます。私たちのアプローチは、MVTec-ADとCIFAR-10を含む異常検出ベンチマークで最先端の性能を達成しています。

## References

1. Abati, D., Porrello, A., Calderara, S., Cucchiara, R.: Latent space autoregression for novelty detection. In: CVPR (2019)
2. Akcay, S., Atapour-Abarghouei, A., Breckon, T.P.: GANomaly: Semi-supervised anomaly detection via adversarial training. In: ACCV (2018)
3. An, J., Cho, S.: Variational autoencoder based anomaly detection using reconstruction probability. Special Lecture on IE (2015)
4. Bergmann, P., Fauser, M., Sattlegger, D., Steger, C.: MVTec AD: a comprehensive real-world dataset for unsupervised anomaly detection. In: CVPR (2019)
5. Bergmann, P., Fauser, M., Sattlegger, D., Steger, C.: Uninformed students: Student-teacher anomaly detection with discriminative latent embeddings. In: CVPR (2020)
6. Bergmann, P., Lwe, S., Fauser, M., Sattlegger, D., Steger, C.: Improving unsupervised defect segmentation by applying structural similarity to autoencoders. In: International Conference on Computer Vision Theory and Applications (2019)
7. Bishop, C.M.: Pattern recognition and machine learning. springer (2006)
8. Borghesi, A., Bartolini, A., Lombardi, M., Milano, M., Benini, L.: Anomaly detection using autoencoders in high performance computing systems. In: AAAI (2019)
9. Carion, N., Massa, F., Synnaeve, G., Usunier, N., Kirillov, A., Zagoruyko, S.: End-to-end object detection with transformers. In: ECCV (2020)
10. Cohen, N., Hoshen, Y.: Sub-image anomaly detection with deep pyramid correspondences. arXiv preprint arXiv:2005.02357 (2020)
11. Defard, T., Setkov, A., Loesch, A., Audigier, R.: PaDim: A patch distribution modeling framework for anomaly detection and localization. In: ICPR (2021)
12. Dehaene, D., Frigo, O., Combretelle, S., Eline, P.: Iterative energy-based projection on a normal data manifold for anomaly localization. In: ICLR (2019)
13. Dehaene, D., Frigo, O., Combretelle, S., Eline, P.: Iterative energy-based projection on a normal data manifold for anomaly localization. In: ICLR (2020)
14. Fei, Y., Huang, C., Jinkun, C., Li, M., Zhang, Y., Lu, C.: Attribute restoration framework for anomaly detection. IEEE Transactions on Multimedia (2020)
15. Golan, I., El-Yaniv, R.: Deep anomaly detection using geometric transformations. In: Bengio, S., Wallach, H.M., Larochelle, H., Grauman, K., Cesa-Bianchi, N., Garnett, R. (eds.) NIPS (2018)
16. Gong, D., Liu, L., Le, V., Saha, B., Mansour, M.R., Venkatesh, S., Hengel, A.v.d.: Memorizing normality to detect anomaly: Memory-augmented deep autoencoder for unsupervised anomaly detection. In: ICCV (2019)
17. He, K., Zhang, X., Ren, S., Sun, J.: Deep residual learning for image recognition. In: CVPR (2016)



tinguishable semantic information. Second, the adoption of transformer prevents reconstructing anomalies well such that anomalies could be detected easily once the reconstruction fails. Our method brings a large generalization gap between normal samples and anomalies. Moreover, we propose novel loss functions to extend our approach from normal-sample-only case to anomaly-available case with both image-level labeled and pixel-level labeled anomalies, further improving the performance. Our approach achieves the state-of-the-art performance on anomaly detection benchmarks including MVTec-AD and CIFAR-10.

## References

1. Abati, D., Porrello, A., Calderara, S., Cucchiara, R.: Latent space autoregression for novelty detection. In: CVPR (2019)
2. Akcay, S., Atapour-Abarghouei, A., Breckon, T.P.: GANomaly: Semi-supervised anomaly detection via adversarial training. In: ACCV (2018)
3. An, J., Cho, S.: Variational autoencoder based anomaly detection using reconstruction probability. Special Lecture on IE (2015)
4. Bergmann, P., Fauser, M., Sattlegger, D., Steger, C.: MVTec AD: a comprehensive real-world dataset for unsupervised anomaly detection. In: CVPR (2019)
5. Bergmann, P., Fauser, M., Sattlegger, D., Steger, C.: Uninformed students: Student-teacher anomaly detection with discriminative latent embeddings. In: CVPR (2020)
6. Bergmann, P., Lwe, S., Fauser, M., Sattlegger, D., Steger, C.: Improving unsupervised defect segmentation by applying structural similarity to autoencoders. In: International Conference on Computer Vision Theory and Applications (2019)
7. Bishop, C.M.: Pattern recognition and machine learning. springer (2006)
8. Borghesi, A., Bartolini, A., Lombardi, M., Milano, M., Benini, L.: Anomaly detection using autoencoders in high performance computing systems. In: AAAI (2019)
9. Carion, N., Massa, F., Synnaeve, G., Usunier, N., Kirillov, A., Zagoruyko, S.: End-to-end object detection with transformers. In: ECCV (2020)
10. Cohen, N., Hoshen, Y.: Sub-image anomaly detection with deep pyramid correspondences. arXiv preprint arXiv:2005.02357 (2020)
11. Defard, T., Setkov, A., Loesch, A., Audigier, R.: PaDim: A patch distribution modeling framework for anomaly detection and localization. In: ICPR (2021)
12. Dehaene, D., Frigo, O., Combexelle, S., Eline, P.: Iterative energy-based projection on a normal data manifold for anomaly localization. In: ICLR (2019)
13. Dehaene, D., Frigo, O., Combexelle, S., Eline, P.: Iterative energy-based projection on a normal data manifold for anomaly localization. In: ICLR (2020)
14. Fei, Y., Huang, C., Jinkun, C., Li, M., Zhang, Y., Lu, C.: Attribute restoration framework for anomaly detection. IEEE Transactions on Multimedia (2020)
15. Golan, I., El-Yaniv, R.: Deep anomaly detection using geometric transformations. In: Bengio, S., Wallach, H.M., Larochelle, H., Grauman, K., Cesa-Bianchi, N., Garnett, R. (eds.) NIPS (2018)
16. Gong, D., Liu, L., Le, V., Saha, B., Mansour, M.R., Venkatesh, S., Hengel, A.v.d.: Memorizing normality to detect anomaly: Memory-augmented deep autoencoder for unsupervised anomaly detection. In: ICCV (2019)
17. He, K., Zhang, X., Ren, S., Sun, J.: Deep residual learning for image recognition. In: CVPR (2016)

