Quantifying Statistical Significance of Deep Nearest Neighbor Anomaly Detection via Selective Inference

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NeurIPS2025

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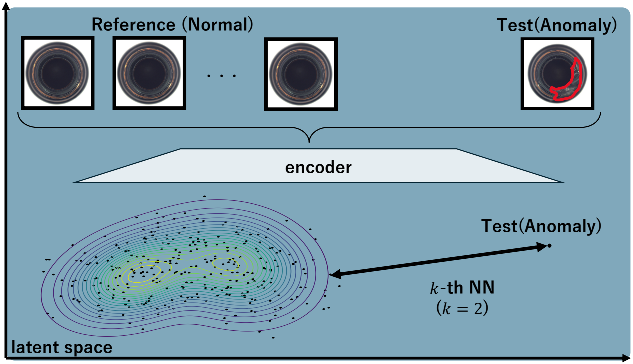
Introduction

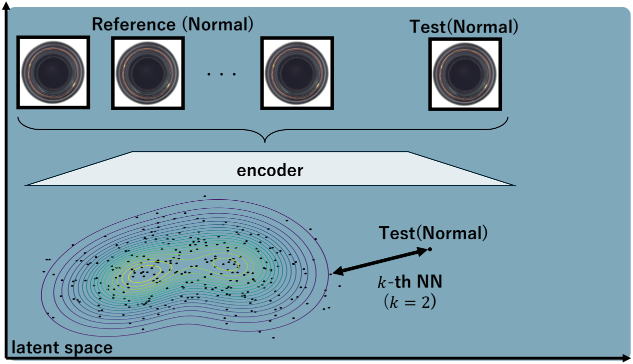
- KNN-based AD(kNNAD) is one of the simplest yet effective methods, which is widely used
  - Performs kNN-based anomaly detection in latent space
  - Effective for high-dimensional and unstructured data such as images



- However, the reliability of detected anomalies is not quantified
- We propose a method to quantify the statistical significance of kNNAD results

Statistical Significance in AD

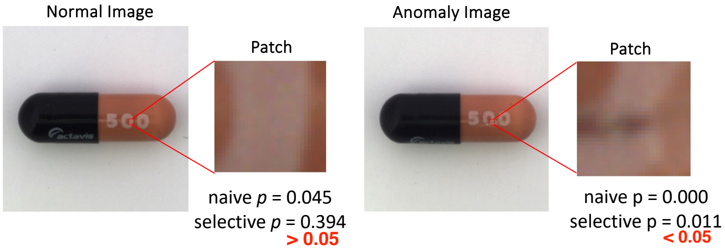
- When a normal image is inputted, kNNAD may **incorrectly** predict normal images as anomaly (**false positive**)



- We quantify the statistical significance of kNNAD as a valid p-value, enabling control of the false positive rate (FPR)

Issue and Our Approach

- We quantify the statistical significance of AD by p-values
- Naive p-values are often underestimated, failing to control the FPR
- This is due to selection bias caused by using the same data for both detection and testing
- We apply **Selective Inference** to rigorously correct this selection bias, enabling proper control of the FPR



MVTec Image Examples