

Report 1: Image Feature Detection and Analysis

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1. Objective

To evaluate and compare different image feature detection methods, analyzing their effectiveness and limitations across various scenarios.

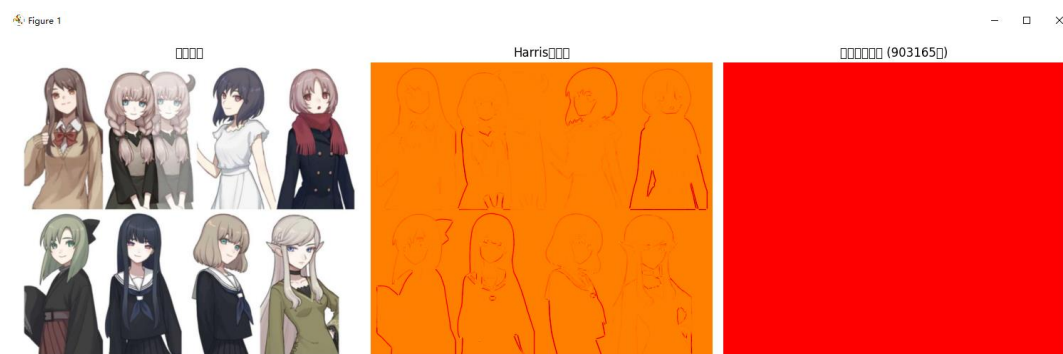
2. Development Environment

1. Python Installation
 - o Recommended version: Python 3.8.6
2. Required Packages
 - o OpenCV-Python: `pip install opencv-python`
 - o OpenCV-Contrib-Python: `pip install opencv-contrib-python`
 - o Additional dependencies as needed

3. Experiments

Construct some codes to extract image

Harris Corner Detection



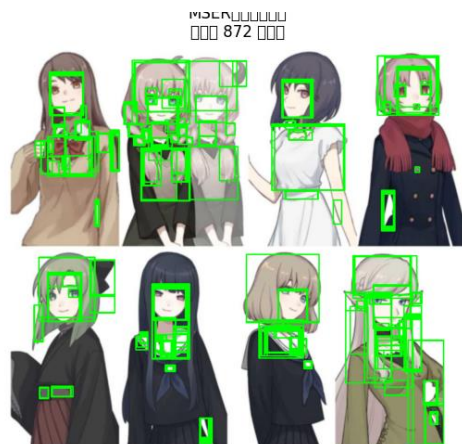
SURF (Speeded-Up Robust Features)



ORB (Oriented FAST and Rotated BRIEF)



MSER (Maximally Stable Extremal Regions)



KAZE/AKAZE



Test Images

Evaluate each method on the following image types:

1. Indoor Scenes

Empty office

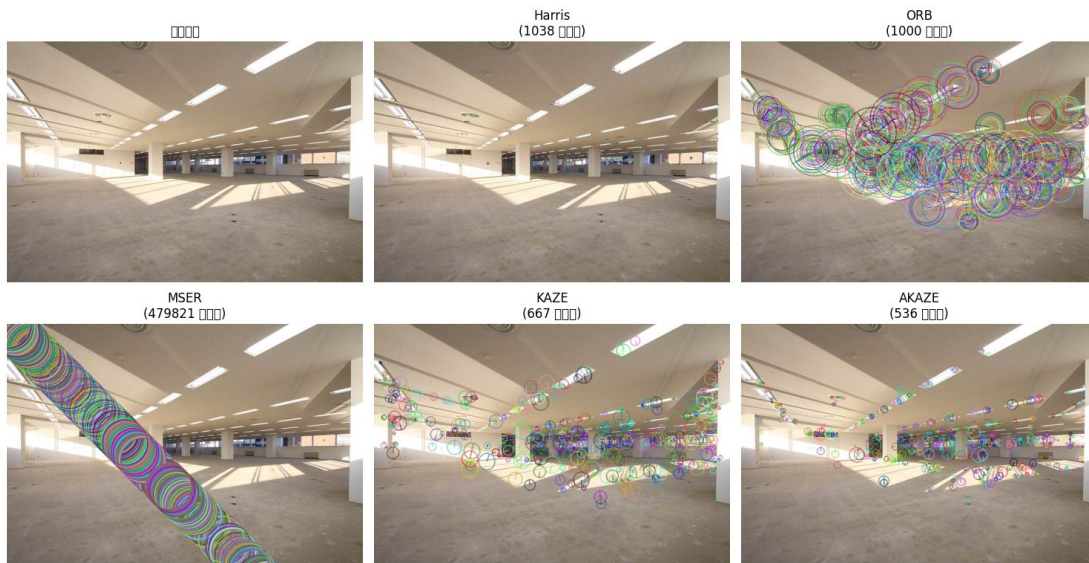
Harris detector: 1038 features detected

ORB detector: 1000 features detected

MSER detector: 479821 features detected

KAZE detector: 667 features detected

AKAZE detector: 536 features detected



U-Aizu lecture room

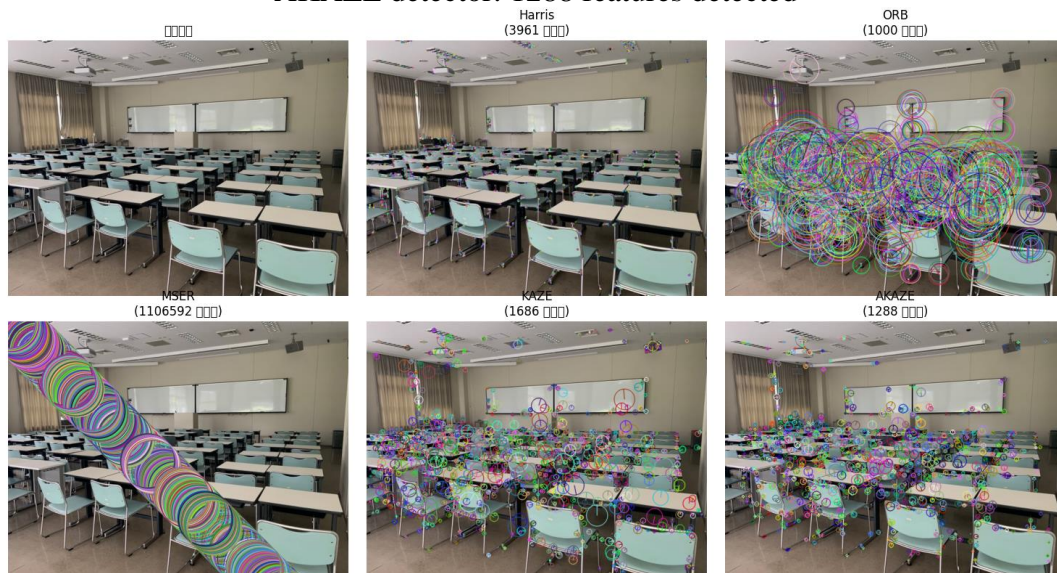
Harris detector: 3961 features detected

ORB detector: 1000 features detected

MSER detector: 1106592 features detected

KAZE detector: 1686 features detected

AKAZE detector: 1288 features detected



U-Aizu building

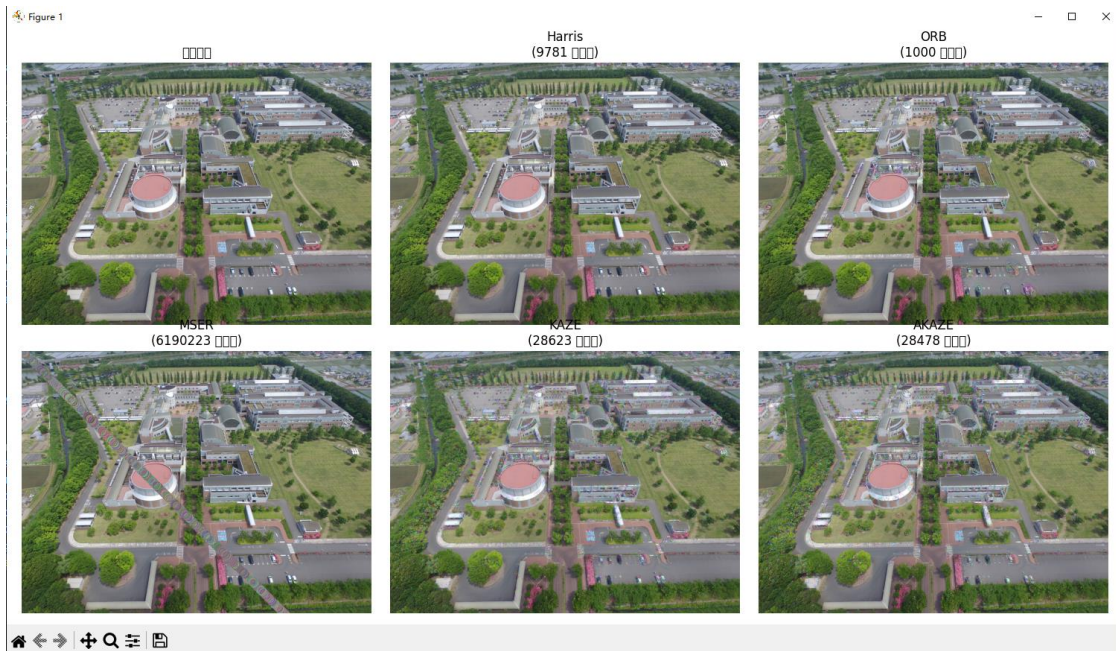
Harris detector: 9781 features detected

ORB detector: 1000 features detected

MSER detector: 6190223 features detected

KAZE detector: 28623 features detected

AKAZE detector: 28478 features detected



2. Outdoor Scenes

Plain road

Harris detector: 618 features detected

ORB detector: 929 features detected

MSER detector: 138626 features detected

KAZE detector: 323 features detected

AKAZE detector: 185 features detected

Figure 1



Normal road

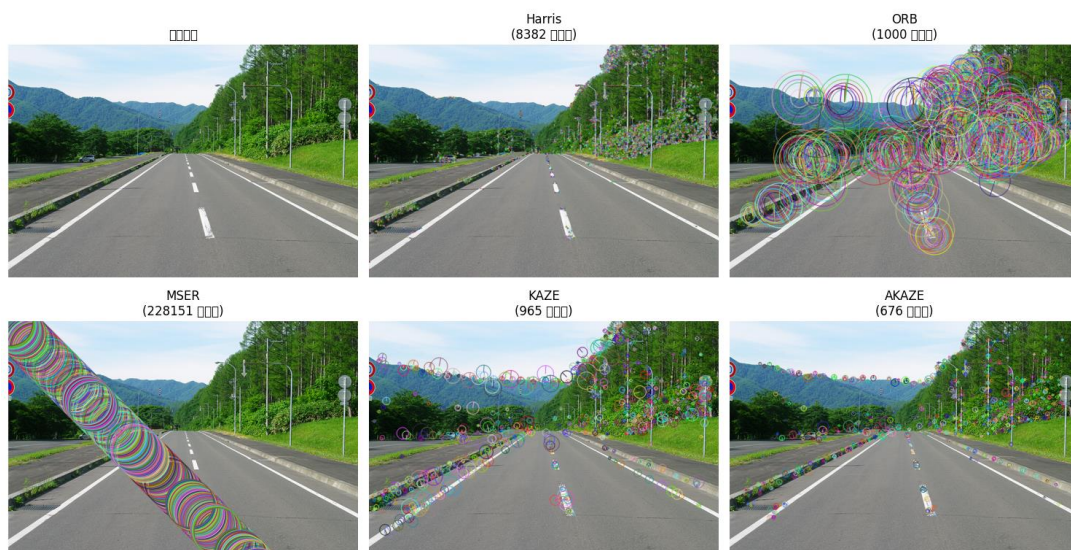
Harris detector: 8382 features detected

ORB detector: 1000 features detected

MSER detector: 228151 features detected

KAZE detector: 965 features detected

AKAZE detector: 676 features detected



Forestry road

Harris detector: 46977 features detected

ORB detector: 1000 features detected

MSER detector: 919555 features detected

KAZE detector: 4910 features detected

AKAZE detector: 4486 features detected



3. Specific Content

Manga characters

Harris detector: 3402 features detected

ORB detector: 1000 features detected

MSER detector: 1745182 features detected

KAZE detector: 3630 features detected

AKAZE detector: 3236 features detected



People/portraits

Harris detector: 2624 features detected

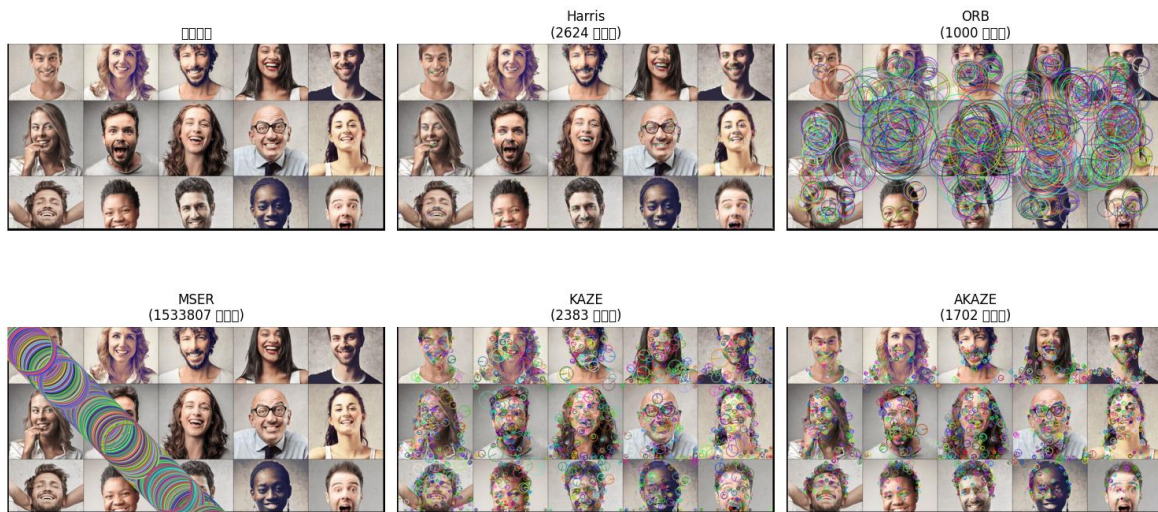
ORB detector: 1000 features detected

MSER detector: 1533807 features detected

KAZE detector: 2383 features detected

AKAZE detector: 1702 features detected

Figure 1



Comparative Analysis

Comparing Original vs Salt and Pepper noise...

ORB: Original vs Salt and Pepper noise:

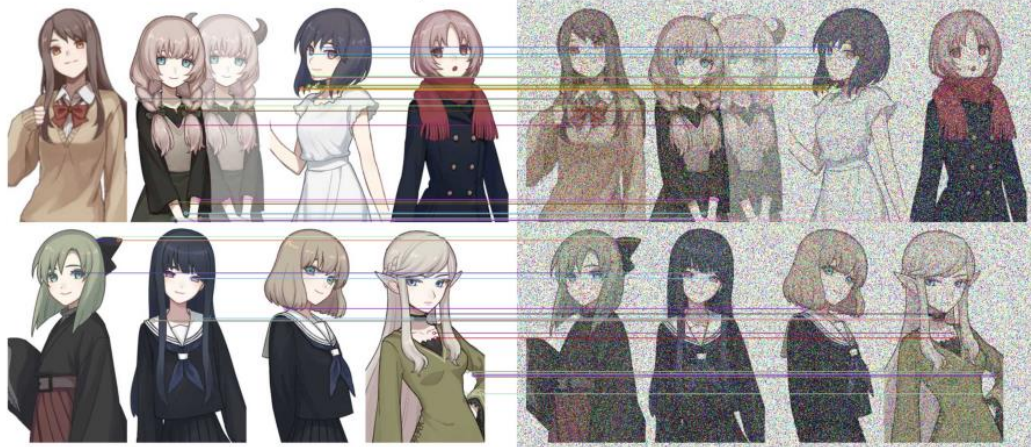
- Number of keypoints in Image 1: 1000
- Number of keypoints in Image 2: 1000
- Number of matches: 50
- Matching rate: 5.00%

Comparing Original vs Gaussian blur...

ORB: Original vs Gaussian blur:

- Number of keypoints in Image 1: 1000
- Number of keypoints in Image 2: 607
- Number of matches: 50
- Matching rate: 8.24%

ORB: Original vs Salt and Pepper noise



ORB: Original vs Gaussian blur



Comparing Original vs Salt and Pepper noise...

SIFT: Original vs Salt and Pepper noise:

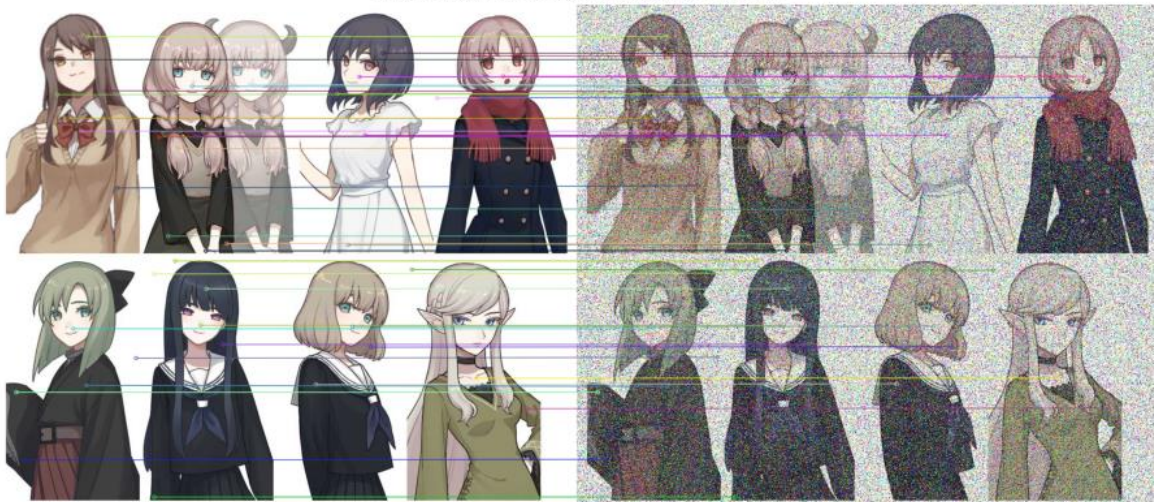
- Number of keypoints in Image 1: 3168
- Number of keypoints in Image 2: 9723
- Number of matches: 50
- Matching rate: 1.58%

Comparing Original vs Gaussian blur...

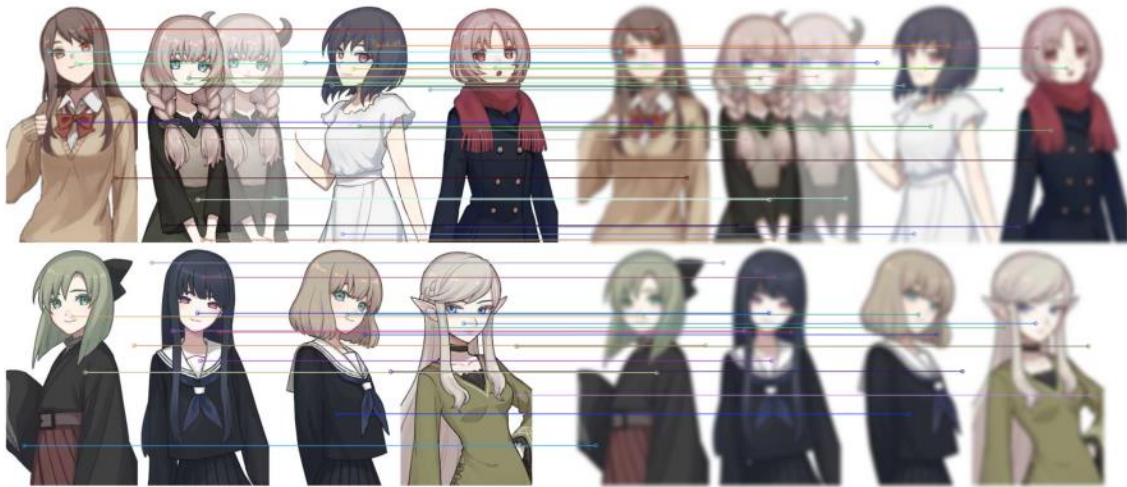
SIFT: Original vs Gaussian blur:

- Number of keypoints in Image 1: 3168
- Number of keypoints in Image 2: 421
- Number of matches: 50
- Matching rate: 11.88%

SIFT: Original vs Salt and Pepper noise



SIFT: Original vs Gaussian blur



KAZE: Original vs Salt and Pepper noise:

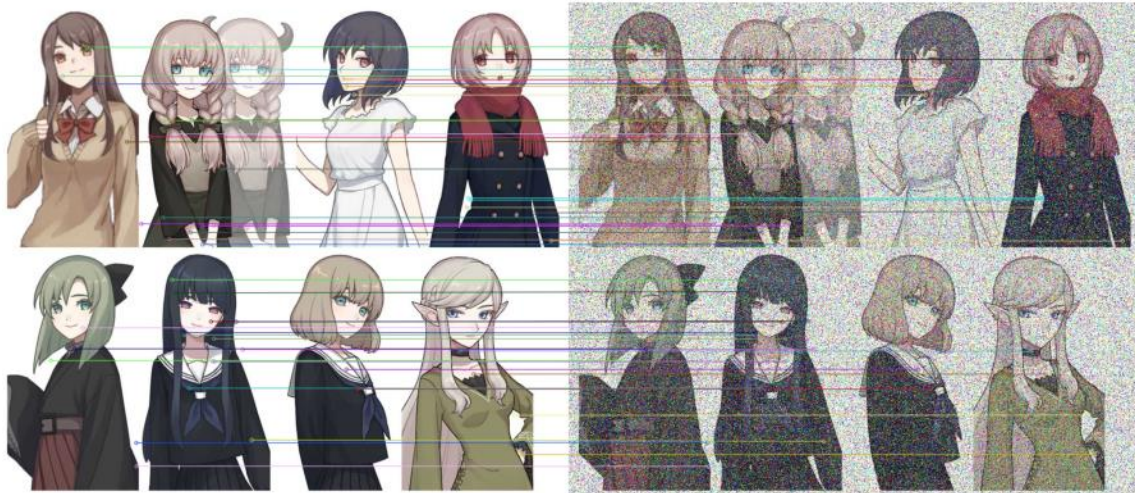
- Number of keypoints in Image 1: 3630
- Number of keypoints in Image 2: 5662
- Number of matches: 50
- Matching rate: 1.38%

Comparing Original vs Gaussian blur...

KAZE: Original vs Gaussian blur:

- Number of keypoints in Image 1: 3630
- Number of keypoints in Image 2: 814
- Number of matches: 50
- Matching rate: 6.14%

KAZE: Original vs Salt and Pepper noise



KAZE: Original vs Gaussian blur



AKAZE: Original vs Salt and Pepper noise:

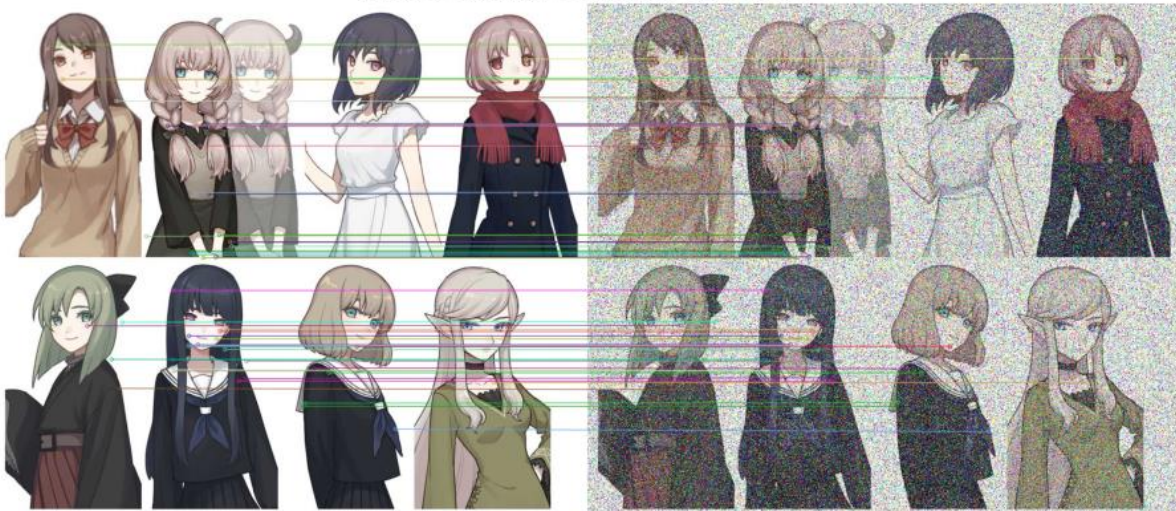
- Number of keypoints in Image 1: 3236
- Number of keypoints in Image 2: 6381
- Number of matches: 50
- Matching rate: 1.55%

Comparing Original vs Gaussian blur...

AKAZE: Original vs Gaussian blur:

- Number of keypoints in Image 1: 3236
- Number of keypoints in Image 2: 1090
- Number of matches: 50
- Matching rate: 4.59%

AKAZE: Original vs Salt and Pepper noise



AKAZE: Original vs Gaussian blur

