Can you remove "shortcuts" from dermatological images?

02501 Advanced Deep Learning in Computer Vision

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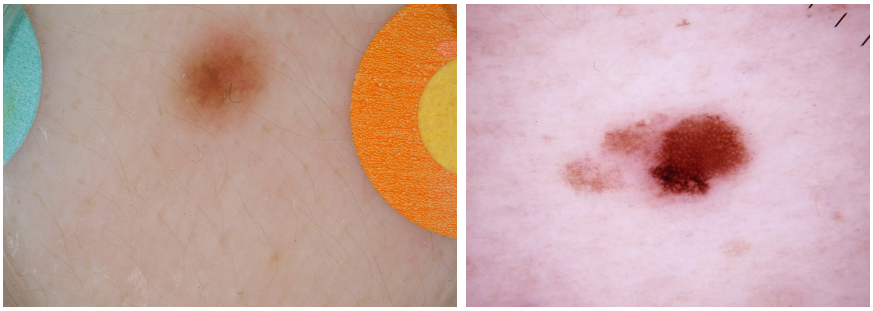

Figure 1: **Outlier image content can act as shortcuts.** Stickers and rulers can act as shortcuts for dermatological imaging diagnostics. Can you remove them?

1 Project description

In this project you can use methods from *Anomaly detection* to remove outlier image content from dermatological images in order to use them for training diagnostic classifiers that do not rely on shortcuts, as well as to test for shortcuts, downstream.

The goal of this project is to utilize diffusion models to build on an anomaly detection pipeline based on [1], to detect the presence of outlier image content, and remove them.

2 Data/Resources

Following [1], you can start building models using the ISIC skin lesion dataset – for ISIC18 I will provide you with annotations of whether or not images contain three types of outlier image content.

3 Tasks

In this project, you could work on the following tasks:
Task 1: Implement and train the diffusion model on ISIC18. Implement the diffusion model, choosing either classifier guidance or classifier free guidance to enable conditioning on the different types of outlier content class.
Task 2: Implement and validate the anomaly detection pipeline. Following [1], implement a pipeline for locating out-of-distribution regions in the image. Validate this by comparing located anomalies with the annotated images with outlier content, or by yourselves manually anntating a small test set, choosing an appropriate metric (or several).
Task 3: Try to improve the model. Based on your results, can you improve on the model? If yes, try!
Task 4: Validate effect on shortcut learning. Create a classifier based on the original data that depends on shortcuts, and design an experiment that demonstrates the shortcut learning. Then create new, cleaned versions of the training data and use your validation pipeline to test whether this reduces shortcut learning.

References

[1] Julia Wolleb, Florentin Bieder, Robin Sandkühler, and Philippe C Cattin. Diffusion models for medical anomaly detection. In *MICCAI*, pages 35–45. Springer, 2022.