REASEACH IDEA

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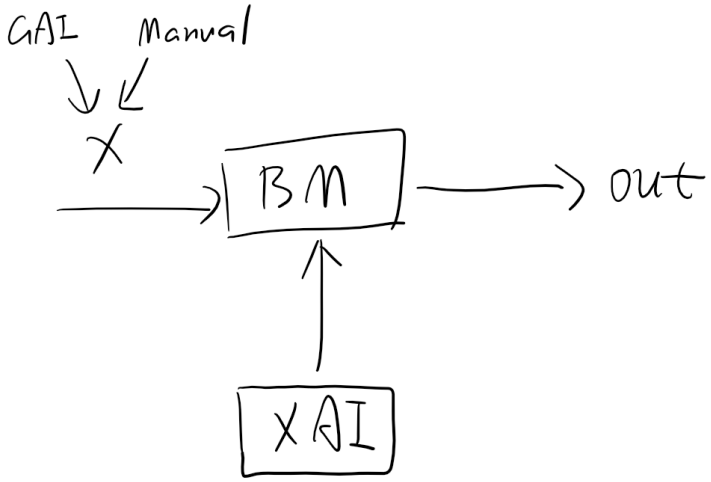
Hightlights:

1) Unify the evaluations of XAI by the perspective of distubution disntance;
2) Using stable difussion models to generate test samples with elaborate purpose;
3) Evaluating the fairness of XAI from different skins, genders, disability, ages;
4) Search-based methods, evaluating the XAI from multiple dimensions.

Details:

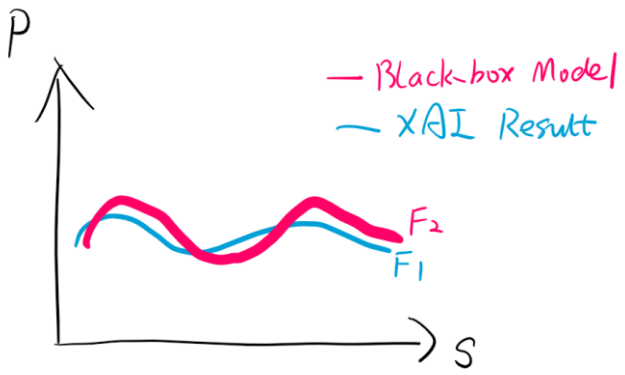
An XAI problem can be illustrated as follow:



Where, X is the input data which can be generated by generative AI models such as diffusion network, or by hand. While BM is the short of Black-box Model. In this paper, we consider the segament anything model(SAM), SSD and Yolo models as BM for the reason that they are heavily related to the essential realms such as auto driving and medicine. (Althogh SAM, SSD and Yolo is opensource, we stilll regard them as BMs)

Meanwhile, seaval well-known XAI methods such as LIME, Grad-CAM and SHAP are ultilized to test the interpredibility of BMs.

In order to test the performance of popular XAI methods, we redefine the problem as the distance of two distrubutions. Here:



The objective of testing problem can be described as optimization probelm:

Minimize: Distance(F1, F2)

It's hard to formula the F2 mathmatically inspite of the explainable F1. So this paper conduct the optimization process by trails. According to the law of large numbers, F1 and F2 can be calculated by a great number of trails. For a trail, the data *x* input to the *BM*, and ouput a reulst *out*. Then we run the XAI method to explain the relationship between the output and the feature maps inside the model, marked as *e.* With different trails, a set would be acquisited as follows:

$\{x_i, out_i, e_i\}$, *i belongs to N, the number of trails.*

Experiments:

E1) Prompt-based, making diverse prompts to generate the suitable x and changes.

Trail types:

1) Keep x constant, change BMs' layers, then make comparisions between e and out.
2) Keep out constant, change x, then make comparisions between e_{i-1} and e_i.
3) Keep x and out constant, change BMs' layers, then make comparisions between e_{i-1} and e_i.

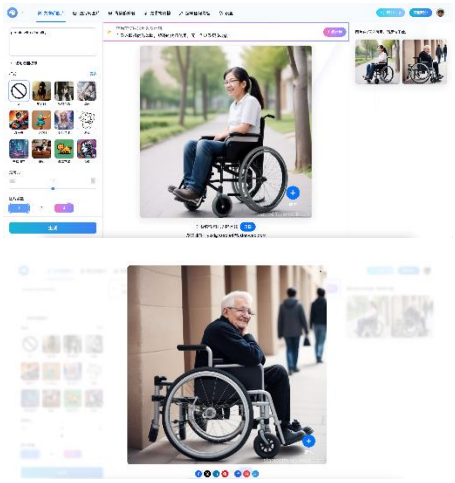
E2) Search-based, generating various inputs, test the BMs and evaluate XAI methods, then summarizing the regular (ie. The distrubutions of BMs and XAI), finially calcualting the distance of F1 and F2.

The performance or the metrics of explanablity *e* can be dividided into some important aspects, such as fairness, faifulness, robustness. Here, we mainly take fairness into account.

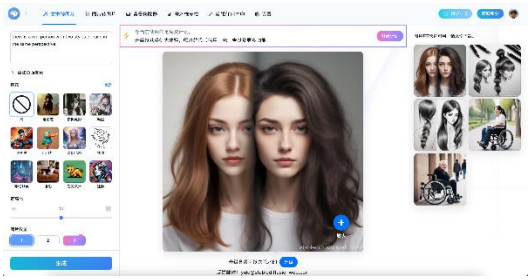
For E1) Prompt-based method, we generated the inputs by stable difussion models.

Examples:

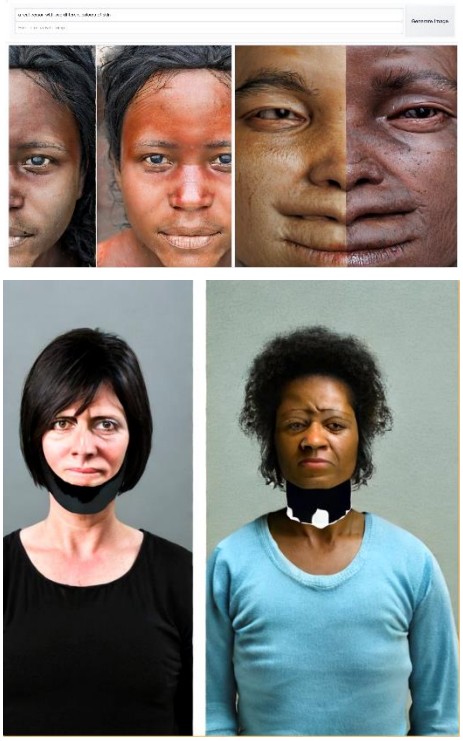
Prompt: people with disability



Prompt: there is a real person with two styles of hairs in the same perspective.



Prompt: a real person with two different colours of skin



Appendix:

Grad CAM: