Proposition of New Experiment to Better Understand the Relation Between Typicality and Prototypes

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I. Introduction

In this paper, I would like to propose an experiment to gain higher knowledge about the bound between typicality and key features of an object. The first step of the experiment is to extract the key features of an image. After extracting the features, we build a prototype of the image. As the last step, through a siamese network, we evaluate the similarity of an image. This process can help us understand if there is a bond between the typicality and resemblance to a prototype.

II. The experiment

The experiment I would like to suggest is composed of some phases. The first thing to do is to collect the images for the experiment. The collected images should be part of different categories like, for example, "birds" or "dogs". Then there is data collection about human typicality judgments. To do this, there should be a survey in which users rate the typicality of the previously collected images. Once the data are complete, in order to reduce possible noise, we should average the data. While collecting the data, there is the possibility to start working on the images. The first step is to extract meaningful features. Some techniques that range from simple edge detection to deformable shape analysis may be functional. Other strategies that require the presence of neural networks, either fully connected or convolutional, are used in medical imaging and can be useful if adapted to a non-medical domain. Moreover, if the dataset contains hyperspectral images, some specific techniques that use convolutional or recurrent neural networks can be used to extract meaningful features. The following step is to build a prototype image based on the features extracted. After building the prototype, the following step is to train a deep learning siamese network that will give a similarity estimation. This kind of network gives a similarity measure between two inputs. A siamese network's training requires a loss function that measures the distance between the two examples fed to the network. This can be helpful since if we use a custom loss function, defined based on human typicality rates, we can have an estimation on how similar is an image to the prototype that humans have. Moreover, if a different loss function is used, there is the possibility to understand how similar are the neural network's and the human's similarity concepts.

Some references

- Edge extraction methods [**?**]
- Shape correspondence [**?**], [**?**]
- Medical imaging feature extraction [**?**]
- CNN feature extraction for pneumonia [**?**]
- Hybrid feature extraction for brain tumour classification [**?**]
- Hyperspectral feature extraction methods [**?**]
- Learning similarity metric for face verification [**?**]
- Learning similarity metrics (Cutting-Edge Trends in Deep Learning and Recognition course, University of Ilinois) [**?**]
- Understanding the contrastive loss reference [**?**]

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