Deep feature and handcrafted feature - A combination for Material Classification

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Introduction

What is it ?

Answer the question "Which material is this object made of?".

brick

leaves

Why do we need it ?

Material is a valuable information for computer to understand and interact with the world.

Which bottle should we use to store hot water?

Auto-car: "Sorry. I don't know it is water".

Only one single image for guessing material - really challenge.

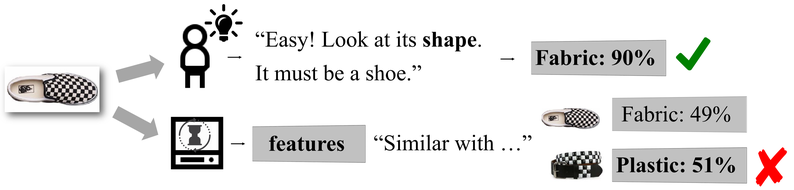
Event for human!

Cool! Look similar texture but it is not too hard.

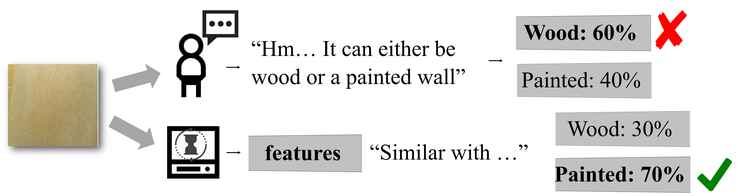
Now. Can use guess which material are they?

Main Idea

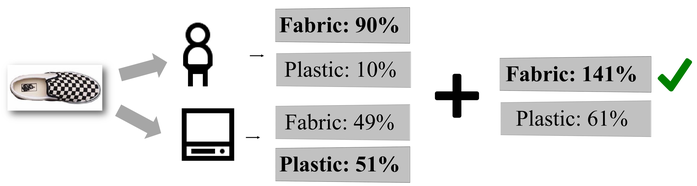
Sometime, human is right ...



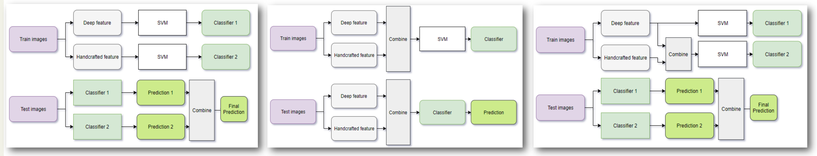
Sometime, computer is right...



So, why don't we combine it?



Approaches



1. Combine predictions

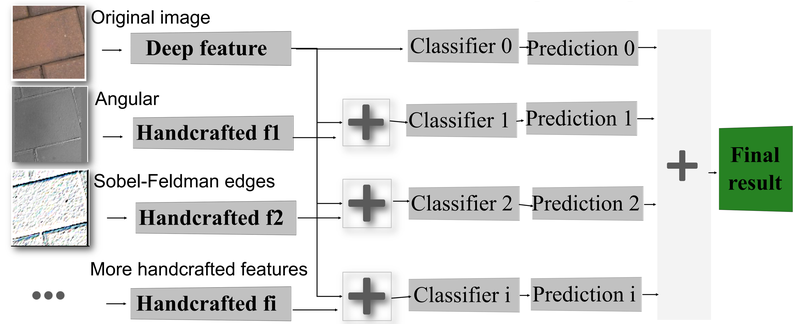
2. Combine features

3. Combine both predictions and features

How it works

We consider that deep feature extracted from a CNN can represent for the way human think and learn.

Combine it with a **suitable** handcrafted feature would improve the prediction.

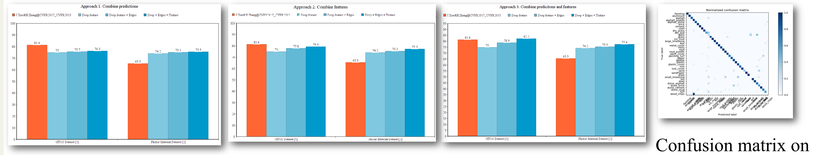


"Suitable" ?

I can recognize type of material base on its shape so I choose **angular** and **edges** as additional information.

Note: We only show flow chart for third approve here (the first and second one are similar).

Results



Some result on GTOS and Flicker Material Dataset

Confusion matrix on GTOS best result

References

[1]Xue, Jia, et al. "Differential angular imaging for material recognition." *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*. Vol. 5. 2017.

[2]H. Zhang, K. Dana, and K. Nishino. Reflectance hashing for material recognition. IEEE Conference on Computer Vision and Pattern Recognition, pages 371–380, 2015. 2, 3