1.Project Title and Members

Wood classification in computer vision: A Survey

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https://github.com/haroldle/feature_engineering_class_project

2.Idea description

Benchmarking multiple state-of-the-art deep learning models (VGG16, ResNet, Vision Transformer) and traditional computer vision models to understand how each feature extraction technique affects the prediction. Traditional Computer vision techniques include LBP - Local Binary Pattern with variants with SVM - Support Vector Machine, and using feature fusion technique (fusing LBP with SIFT - Scale Invariant Feature Transform descriptor); inspired by [4]

3.Goals and Objectives:

Goal: This paper aims to answer two questions: Can deep learning models perform better than the proposed method in An automatic recognition system? How does each feature extraction technique affect the performance of the models?

Objectives: In answering those questions, these are the objectives:

1. Understanding the image dataset
2. Recreating the model from D. V. Souza *et al* [2]
3. Creating a simple feature fusion model (SIFT with LBP) that is based on Feng Yang, Zheng Ma, and Mei Xie [3]
4. Doing Transferred Learning on VGG16, Siamese Net, Vision Transformer.
5. Comparing between models

4. Motivation

Computer vision based on wood classification is a small area in wood science [5]. This paper could be an inspiration for expanding computer vision based on wood classification.

5. Significance

The significance of this paper is trying to introduce wood anatomists to a better way to classify wood. According to Hwang SW, Sugiyama J [5], the wood classification process is still manual work. Besides that, classifying wood correctly is “the fundamental aspect for the conservation flora.” [2]

6. Literature Survey (Related work)

LBP (multiple variants). LBP has been used intensively in wood classification [2, 5] and defection [7]. By fusing LBP variants, the machine learning model performances greatly increase [2].

Vanilla CNN. Vanilla CNN - (VGG16 and ResNet) - is used in wood classification [5]. These models have a potential in learning the feature patterns of the woods’ images.

7. Objectives

Understanding the image dataset

Recreating the model from D. V. Souza *et al* [2]

Creating a simple feature fusion model (SIFT with LBP) that is based on Feng Yang, Zheng Ma, and Mei Xie [3]

Doing Transferred Learning on VGG16, Siamese Net, Vision Transformer.

Comparing between models

8. Features

The dataset is from D. V. Souza *et al* [2]. It contains 46 different wood species. For each species, there are roughly 17 images.

Some of the feature extraction techniques that we are using are:

1. Local Binary Pattern (texture feature), [2, 5, 7]
2. SIFT (local feature), [1]
3. Feature fusion (fusing multiple features for classifying) (SIFT with LBP) or (LBP with multiple variation),; inspired [4]
4. CNN (convolutional neural network - vanilla VGG), [8]
5. Siamese - calculating distance between feature vectors (two CNN models) [6]
6. Transformers (discarding CNN and only using an attention mechanism to learn; in this case, it learns the image pixel directly without doing any convolutional technique.) [3]

9. Expected outcome

Due to the tiny dataset, we expect the traditional computer vision pipeline (LBP, SIFT, feature fusion + machine learning algorithm) to outperform the deep learning models. Among the deep learning models, Siamese or Transformer could perform better than other state-of-the-art models.

10. References

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