Finetune ResNet for Reservoir Detection

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This method is a kind of transfer learning. It uses pre-trained model as feature extractor, and uses the extracted features to learn a model to fit our data. The pretrained model used is ResNet [1]. ResNet is a kind of convolutional neural networks (CNN)[1]. Those networks are particularly used to extract features of images. I used PyTorch[2] to implement the method.

1 Brief Introduction to ResNet structure

ResNet used in this project contains 18 layers. The outputs of the second last layer are the features extracted by the previous 17 convolutional layers. The last layer is a Softmax Layer [3]. The input for this classifier is the output of the second last layer (the extracted features). The outputs of the last layer are the probabilities to both classes (natural lake or reservoir). The final class label will be assigned to the one with larger probability.

2 Detail steps

1. Reshape all the iamges to 224×224, since ResNet requires the input size to be 224×224
2. Load the pretrained ResNet.
3. Reshape the last layer of ResNet to have the same number of outputs as the number of classes in our dataset.
4. Define for the optimization algorithm which parameters we want to update during training. Now, I am using Adam [2]. We can also use other optimization method.
5. Train the model by PyTorch and validate the trained model.
    - First, I split the dataset into 10 folds.

[1] https://towardsdatascience.com/simple-introduction-to-convolutional-neural-networks-cdf8d3077bac

[2] https://pytorch.org

[3] https://developers.google.com/machine-learning/crash-course/multi-class-neural-networks/softmax

- Each time, I used 9 folds to train the model and the remaining 1 fold to validation the model. This step is repeated for 10 times such that all the folds could be used in validation phase.
- Record the outputs of the validation phase.

6. Assign the class labels to the samples by the outputs of the validatoin phase.

Reference

[1] Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. Deep residual learning for image recognition. In *Proceedings of the IEEE conference on computer vision and pattern recognition*, pages 770–778, 2016.

[2] Diederik P Kingma and Jimmy Ba. Adam: A method for stochastic optimization. *arXiv preprint arXiv:1412.6980*, 2014.