Machine Learning Kaggle Project

What's Cooking

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1. Introduction

The main problem

The main issue of this competition is to classify lists of ingredients into correct kinds of cuisines. There are only two given files `train.json` and `test.json`. Each training instance is represented in this format of JSON.

```
{
    "id": 10259,
    "cuisine": "greek",
    "ingredients": [ "romaine lettuce", "black olives", "grape tomatoes", "garlic",
    "pepper", "purple onion", "seasoning", "garbanzo beans", "feta cheese crumbles" ]
}
```

And, each testing instance is represented in the format of JSON.

```
{
    "id": 18009,
    "ingredients": [ "baking powder", "eggs", "all-purpose flour",
    "raisins", "milk", "white sugar" ]
}
```

There are totally 20 kinds of cuisines.

irish	**mexican**	**chinese**	**filipino**	**vietnamese**
moroccan	**brazilian**	**japanese**	**british**	**greek**
indian	**jamaican**	**french**	**spanish**	**russian**
cajun_creole	**thai**	**southern_us**	**korean**	**italian**

After an initial step of statistics, some basic summaries about data are given below.

Number of training instances	39774
Number of testing instances	9944
Length of longest list of ingregients in training data	65
Length of shortest list of ingregients in training data	1
Total number of ingregients in training data	6714

The submission needs to be saved as a csv file of this form.

id	cuisine
18009	italian
35203	chinese
...	...

Obviously, this competition is a **supervised problem** of **multi-class classification**. There are several kinds of applicable classifiers.

- Transform to binary - OvR, OvO
- Extend from binary - Naive Bayes, KNN, Decision trees, SVM, Neural networks, ELM
- Hierarchical classification

The main steps of learning

There are five major steps of machine learning in this project.

- **Data analysis** - We dealt with **data preprocessing** and decided the form of data representation in this step, which will be mentioned later in this subsection.
- **Visualization** - According to the above result, the data matrix derived from the training instances has size of 39774 x 6714. To cope with this matrix more efficiently, we need **dimension reduction** to compress the size of data without losing too many varieties of data. The methods mentioned in the sections 2 and 3 adopted different ways to achieve dimension reduction.
- **Modeling** - We chose **Weka** environment to create models. The process of converting data matrix to the valid file for Weka environment will be mentioned in the sections 2 and 3. The detailed steps of how to use Weka will be described in the appendix.
- **Tuning** - In the section 3, we defined a special score to determine the number of principal components used to reduce the dimension. And then, we used the **AutoWeka** tool to choose appropriate parameters needed in the candidate models. The detailed steps of how to use AutoWeka will be described in the appendix.
- **Evaluation** - In the section 4, we presented various quantitiest to evaluate old method and our

method. These evidences showed that our method works better than the old one. Finally, we gave the scores of our submissions on Kaggle site.

Data preprocessing

- delete special characters(appendix)
- convert to unitcode(appendix)
- change to 01-vectors
- a matrix of size 39774 x 6714 (training) without missing values -> very large!

2. Related work

- Top ing. + J48 -> sketch the method
- Dimension reduction -> Top ing.
- Modeling -> Weka (detailed steps)
- Tuning -> How to choose num. of top ing.?
- Best: Top 1000, S=0.57; Top 1703, S=???

3. New methods

- PCA + SMO -> sketch the method
- Dimension reduction -> PCA, linear unsupervised reduction
- Modeling -> Auto Weka + Weka (detailed steps)
- Tuning -> 1. How to choose num. of PCs? Score.pdf 2. How to choose parameters of SMo? AutoWeka
- Best: PCs 1000, S=0.66020; PCs 1703, S=???

4. Comparison results

Evaluation

- Correctness / Accuracy / Error rate
- K-fold cross-validation
- Confusion matrix
- ROC curve
- AUC value

Testing

- Testing -> Weka (detailed steps)
- Kaggle score (Screen Shot)

5. Discussion and conclusion

- Why did the new methods work better?
- Future work: Text mining, Compressed sensing, Factorization Machines (2010), Latent Dirichlet Allocation.

Appendix

- How to use Weka & Version of Weka
- How to use Automatic Weka & & Version of AutoWeka
- Coding
    - You can find all the codes in this site. https://github.com/alicia6174/Kaggle-Whats-Cooking
    - Please contact this mail if you have any question. yhguan8128@gmail.com

References

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2. 袁梅宇. *王者歸來：WEKA機器學習與大數據聖經 3/e.* 佳魁資訊, 2016.