基于weka的分类算法研究报告

数据:802_ENGLISH_XLS1.csv

Preprocess

先不考虑TID,SID

credit 数据存在问题

clusterer first

做聚类分析后影响分类的主要因素为

1. recurting way
2. stype
3. sage_in
4. sage_out
5. delay_year

所以,最明显的结果就是,毕业延迟与博硕,招生方式,入学时间有极大关联.....

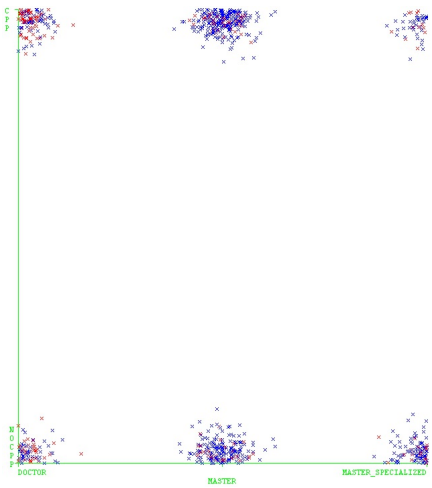
对于employment_unit_class影响不大.....

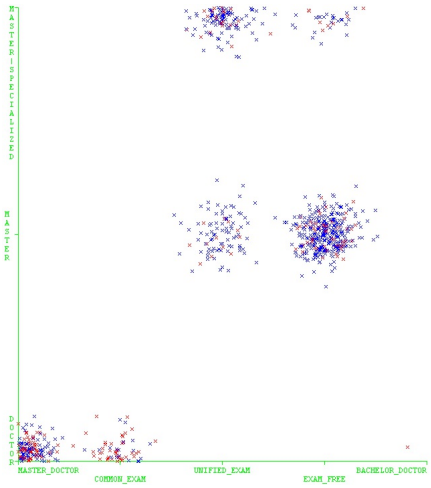
credit 数据存在问题

手工分析 (使用trees.UserClassifier)

employment_unit_class与以下属性存在强相关(不存在的)

唯一比较明显的的特征:





选择属性 (或使用AttributeSelectedClassifier)

```
weka.attributeSelection.CfsSubsetEval -P 1 -E 1

Selected attributes: 1,2,3,12,20,21,33,34 : 8
                     YEAR_IN
                     RECRUITING_WAY
                     STYPE
                     SAGE_OUT
                     CREDIT
                     GPA
                     DALEY_YEAR
                     DELAY
```

使用CVParameterSelection调整参数

分类算法

参见袁梅宇. 数据挖掘与机器学习:WEKA应用技术与实践 (Kindle 位置 1508-1509). 清华大学出版社. Kindle 版本. 8379.

Weka的分类算法按照其功能分为如下七种：bayes(贝叶斯) functions(功能)、lazy(消极),meta(元),misc(杂项),rules(规则) 和trees(树)。

袁梅宇. 数据挖掘与机器学习:WEKA应用技术与实践 (Kindle 位置 8395-8396). 清华大学出版社. Kindle 版本.

不同分类算法的比较(meta,misc算法除外)

用experimenter功能实现以提高效率

全部采用默认参数

分类算法	ned-ned	ed-ned	ned-ed	ed-ed	edTP	nedTP	注记
贝叶斯	504	97	102	99	0.492537313	0.838602329	
朴素贝叶斯	515	86	117	84	0.417910448	0.856905158	
逻辑斯蒂回归	522	49	142	59	0.293532338	0.914185639	我觉得functions里的都比较悬
反向传播	492	109	124	77	0.383084577	0.818635607	"很慢很慢
SGD随机梯度下降	568	33	157	44	0.218905473	0.945091514	"nedTP很高
简单逻辑斯蒂	565	36	151	50	0.248756219	0.940099834	
SMO序列最小优化算法	582	19	163	38	0.189054726	0.968386023	

ibk k最近邻分类器	466	135	135	66	0.328358209	0.775374376	
kstar	483	118	136	65	0.323383085	0.803660566	稍慢
lwl局部加权学习	556	45	149	52	0.258706468	0.925124792	
InputMappedClassifier					#DIV/0!	#DIV/0!	
DecisionTable	551	50	146	55	0.273631841	0.916805324	
Jrip	541	60	131	70	0.348258706	0.900166389	
OneR	545	56	171	30	0.149253731	0.906821963	kappa过低不考虑
PART	471	130	126	75	0.373134328	0.783693844	
ZEROR					#DIV/0!	#DIV/0!	
决策树桩	522	79	128	73	0.36318408	0.868552413	
J48 C4.5决策树	534	67	139	62	0.308457711	0.888519135	
LMT逻辑斯蒂模型树	565	36	151	50	0.248756219	0.940099834	
随机森林	560	41	143	58	0.288557214	0.931780366	
随机树	460	141	136	65	0.323383085	0.765391015	kappa过低不考虑
REP树	544	57	147			0.90515807	

meta算法中用贝叶斯和J48,决策树桩考虑

元分类算法分析

使用AttributeSelectedClassifier可能提高效果(先进行相关属性选择)

通过CVParameterSelection来调整参数(试参数时用)

AdaboostM1(标称数据),AddictiveRegression:用一种方法迭代提高准确率

Bagging(降方差)

MultiScheme:从多种方法中选择

表现(相对)良好的几种算法

贝叶斯

```
=== Run information ===

Scheme:       weka.classifiers.bayes.BayesNet -D -Q weka.classifiers.bayes.net.search.local.K2 --
-P 1 -S BAYES -E weka.classifiers.bayes.net.estimate.SimpleEstimator -- -A 0.5
Relation:     802_ENGLISH_XLS1re
Instances:    802
Attributes:   34
......

Test mode:    10-fold cross-validation

=== Classifier model (full training set) ===

Bayes Network Classifier
not using ADTree
#attributes=34 #classindex=31
Network structure (nodes followed by parents)
YEAR_IN(1): EMPLOYMENT_UNIT_CLASS
```

```
RECRUITING_WAY(5): EMPLOYMENT_UNIT_CLASS
STYPE(3): EMPLOYMENT_UNIT_CLASS
MAJOR(6): EMPLOYMENT_UNIT_CLASS
NATION(2): EMPLOYMENT_UNIT_CLASS
SEX(2): EMPLOYMENT_UNIT_CLASS
SAGE_IN(2): EMPLOYMENT_UNIT_CLASS
CPP_MEMBER(2): EMPLOYMENT_UNIT_CLASS
INTERVIEW_SCORE_01(1): EMPLOYMENT_UNIT_CLASS
INTERVIEW_SCORE_CLASS(4): EMPLOYMENT_UNIT_CLASS
985_211(3): EMPLOYMENT_UNIT_CLASS
SAGE_OUT(2): EMPLOYMENT_UNIT_CLASS
CONTINUOUS_EDUCATION(2): EMPLOYMENT_UNIT_CLASS
CHANGE_MAJOR(2): EMPLOYMENT_UNIT_CLASS
TAGE_SIN(1): EMPLOYMENT_UNIT_CLASS
TCPP_MEMBER(2): EMPLOYMENT_UNIT_CLASS
TTITLE(3): EMPLOYMENT_UNIT_CLASS
TDUTY(2): EMPLOYMENT_UNIT_CLASS
EXPERT(2): EMPLOYMENT_UNIT_CLASS
CREDIT(3): EMPLOYMENT_UNIT_CLASS
GPA(2): EMPLOYMENT_UNIT_CLASS
GPA_CLASS(4): EMPLOYMENT_UNIT_CLASS
GPA_01(1): EMPLOYMENT_UNIT_CLASS
GPA_MAIN(1): EMPLOYMENT_UNIT_CLASS
GPA_CLASS_MAIN(4): EMPLOYMENT_UNIT_CLASS
GPA_MAIN_01(1): EMPLOYMENT_UNIT_CLASS
PROPOSAL_GRADE(3): EMPLOYMENT_UNIT_CLASS
MID_GRADE(3): EMPLOYMENT_UNIT_CLASS
JUDGING_GRADE(2): EMPLOYMENT_UNIT_CLASS
ANSWERING_GRADE(2): EMPLOYMENT_UNIT_CLASS
TIME_TO_PROPOSAL(1): EMPLOYMENT_UNIT_CLASS
EMPLOYMENT_UNIT_CLASS(2):
DALEY_YEAR(2): EMPLOYMENT_UNIT_CLASS
DELAY(2): EMPLOYMENT_UNIT_CLASS
LogScore Bayes: -16390.47907741949
LogScore BDeu: -16519.331041720074
LogScore MDL: -16528.285518975586
LogScore ENTROPY: -16224.02207731766
LogScore AIC: -16315.02207731766


Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         603               75.187  %
Incorrectly Classified Instances       199               24.813  %
Kappa statistic                          0.3339
Mean absolute error                      0.2683
Root mean squared error                  0.4803
Relative absolute error                 71.3496 %
Root relative squared error            110.8278 %
Total Number of Instances              802

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area
Class
                 0.839    0.507    0.832      0.839    0.835      0.334    0.672     0.822
NO_EDUCATION_RESEARCH
                 0.493    0.161    0.505      0.493    0.499      0.334    0.672     0.439
EDUCATION_RESEARCH
Weighted Avg.    0.752    0.421    0.750      0.752    0.751      0.334    0.672     0.726

=== Confusion Matrix ===
```

```
   a   b   <-- classified as
 504  97 |   a = NO_EDUCATION_RESEARCH
 102  99 |   b = EDUCATION_RESEARCH
```

但是.....贝叶斯的结果真的要多简洁有多简洁/滑稽

weka.classifiers.trees.J48 -C 0.25 -M 2

> 这是此分类器默认的参数设置， 对于J48分类器，很少需要为获得良好的性能而更改这些参数。 袁梅宇. 数据挖掘与机器学习:WEKA应用技术与实践 (Kindle 位置 1508-1509). 清华大学出版社. Kindle 版本.

- 对于从事教育相关的阳性率达到50%,且假阳性率极低仅为3.2%
- 进行人工集成学习?
- re: cross-v之后只剩30%,10%了.....还是不靠谱

实际上,调整到-C 0.1 -M 10效果会好一些

```
=== Run information ===

Scheme:       weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     802_ENGLISH_XLS1
Instances:    802


=== Summary ===

Correctly Classified Instances         694               86.5337 %
Incorrectly Classified Instances       108               13.4663 %
Kappa statistic                          0.5945
Mean absolute error                      0.2201
Root mean squared error                  0.3318
Relative absolute error                 58.559  %
Root relative squared error             76.5553 %
Total Number of Instances              802

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area
Class
                 0.968    0.443    0.867      0.968    0.915      0.616    0.819     0.903
NO_EDUCATION_RESEARCH
                 0.557    0.032    0.855      0.557    0.675      0.616    0.819     0.698
EDUCATION_RESEARCH
Weighted Avg.    0.865    0.340    0.864      0.865    0.855      0.616    0.819     0.852

=== Confusion Matrix ===

   a   b   <-- classified as
 582  19 |   a = NO_EDUCATION_RESEARCH
  89 112 |   b = EDUCATION_RESEARCH
```

weka.classifiers.trees.DecisionStump

数据很好看,但是看下结果就发现.....不太靠谱

```
=== Run information ===

Scheme:       weka.classifiers.trees.DecisionStump
Relation:     802_ENGLISH_XLS1re
Instances:    802
Attributes:   34

Test mode:    10-fold cross-validation

=== Classifier model (full training set) ===

Decision Stump

Classifications

STYPE = DOCTOR : EDUCATION_RESEARCH
STYPE != DOCTOR : NO_EDUCATION_RESEARCH
STYPE is missing : NO_EDUCATION_RESEARCH

Class distributions

STYPE = DOCTOR
NO_EDUCATION_RESEARCH    EDUCATION_RESEARCH
0.49246231155778897      0.507537688442211
STYPE != DOCTOR
NO_EDUCATION_RESEARCH    EDUCATION_RESEARCH
0.8341625207296849       0.16583747927031509
STYPE is missing
NO_EDUCATION_RESEARCH    EDUCATION_RESEARCH
0.7493765586034913       0.2506234413965087


Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         595               74.1895 %
Incorrectly Classified Instances       207               25.8105 %
Kappa statistic                          0.2522
Mean absolute error                      0.3325
Root mean squared error                  0.4081
Relative absolute error                 88.4299 %
Root relative squared error             94.1648 %
Total Number of Instances              802

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area
Class
                 0.869    0.637    0.803      0.869    0.835      0.256    0.639     0.809
NO_EDUCATION_RESEARCH
                 0.363    0.131    0.480      0.363    0.414      0.256    0.639     0.375
EDUCATION_RESEARCH
Weighted Avg.    0.742    0.510    0.722      0.742    0.729      0.256    0.639     0.700

=== Confusion Matrix ===

   a   b   <-- classified as
 522  79 |   a = NO_EDUCATION_RESEARCH
 128  73 |   b = EDUCATION_RESEARCH
```

meta大杂烩

```
weka.classifiers.meta.Vote -S 1 -B "weka.classifiers.bayes.BayesNet -D -Q
weka.classifiers.bayes.net.search.local.K2 -- -P 1 -S BAYES -E
weka.classifiers.bayes.net.estimate.SimpleEstimator -- -A 0.5" -B
"weka.classifiers.bayes.NaiveBayes " -B "weka.classifiers.trees.DecisionStump " -B
"weka.classifiers.trees.J48 -C 0.25 -M 2" -R AVG
```

```
Time taken to build model: 0.02 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         608               75.8105 %
Incorrectly Classified Instances       194               24.1895 %
Kappa statistic                          0.3294
Mean absolute error                      0.2948
Root mean squared error                  0.4258
Relative absolute error                 78.4196 %
Root relative squared error             98.2609 %
Total Number of Instances              802

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area
Class
                 0.859    0.542    0.826      0.859    0.842      0.331    0.668     0.820
NO_EDUCATION_RESEARCH
                 0.458    0.141    0.520      0.458    0.487      0.331    0.668     0.457
EDUCATION_RESEARCH
Weighted Avg.    0.758    0.442    0.749      0.758    0.753      0.331    0.668     0.729

=== Confusion Matrix ===

   a   b   <-- classified as
 516  85 |   a = NO_EDUCATION_RESEARCH
 109  92 |   b = EDUCATION_RESEARCH
```

但是,主要的影响因素还是Doctor/not

Tree的进一步讨论

J48 参见 http://www.cnblogs.com/chamie/p/4523976.html,基于信息增益构建树. 效果拔群,参数简单,而且便于解释.

decision stump 一刀切\单层决策树

http://blog.csdn.net/lanchunhui/article/details/50980635

随机森林 参见 http://www.cnblogs.com/hrlnw/p/3850459.html