



**ACADGILD**

# SESSION 13: Decision Tree Based Models

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## Assignment 3

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## 1. Introduction

This assignment will help you understand the concepts learnt in the session.

## 2. Objective

This assignment will test your skills on the basics of decision tree.

## 3. Prerequisites

Not applicable.

## 4. Associated Data Files

Not applicable.

## 5. Problem Statement

1. Use the given link below:

<https://archive.ics.uci.edu/ml/machine-learning-databases/00304/>

Problem- prediction of the number of comments in the upcoming 24 hours on those blogs, the train data was generated from different base times that may temporally overlap. Therefore, if you simply split the train into disjoint partitions, the underlying time intervals may overlap. Therefore, you should use the provided, temporally disjoint train and test splits to ensure that the evaluation is fair.

- a. Interpret the final model coefficients.
- b. Plot the model result and compare it with assumptions of the model.



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# SESSION 13: Decision Tree Based Models

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## Assignment 1

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## **6. 1. Introduction**

This assignment will help you understand the concepts learnt in the session.

## **7. 2. Objective**

This assignment will test your skills on the basics of decision tree.

## **8. 3. Prerequisites**

Not applicable.

## **9. 4. Associated Data Files**

Not applicable.

## **10. 5. Problem Statement**

1. Use the given link below:

<https://archive.ics.uci.edu/ml/machine-learning-databases/00304/>

Problem- prediction of the number of comments in the upcoming 24 hours on those blogs, the train data was generated from different base times that may temporally overlap. Therefore, if you simply split the train into disjoint partitions, the underlying time intervals may overlap. Therefore, the you should use the provided, temporally disjoint train and test splits to ensure that the evaluation is fair.

- a. Read the dataset and identify the right features.
- b. Clean dataset, impute missing values and perform exploratory data analysis.

- c. Visualize the dataset and make inferences from that.
- d. Perform any 3 hypothesis tests using columns of your choice, make conclusions.

Problem- prediction of the number of comments in the upcoming 24 hours on those blogs, The train data was generated from different base times that may temporally overlap. Therefore, if you simply split the train into disjoint partitions, the underlying time intervals may overlap. Therefore, the you should use the provided, temporally disjoint train and test splits to ensure that the evaluation is fair.

- a. Read the dataset and identify the right features
- b. Clean dataset, impute missing values and perform exploratory data analysis.
- c. Visualize the dataset and make inferences from that
- d. Perform any 3 hypothesis tests using columns of your choice, make conclusions
- e. Create a linear regression model to predict the number of comments in the next 24 hours (relative to basetime)
- f. Fine tune the model and represent important features
- g. Interpret the summary of the linear model
- h. Report the test accuracy vs. the training accuracy
- i. Interpret the final model coefficients
- j. Plot the model result and compare it with assumptions of the model

```
#### Data Preprocessing ####
```

```
library(data.table) library(foreach)
```

```
library(readr)
```

```
# [1] "C:/Users/Downloads/New folder (2)" setwd("C:/Users/archana/Desktop/BlogFeedback")
```

```
# [1] "C:/Users/seshan/Downloads/New folder (2)"
```

```
blogData_train <- read_csv("C:/Users/archana/Desktop/BlogFeedback/blogData_train.csv")
```

```
## Warning: Duplicated column names deduplicated: '0.0' => '0.0_1' [8],
```

```
## '0.0' => '0.0_2' [13], '377.0' => '377.0_1' [14], '0.0' => '0.0_3' [18],
```

```
## '377.0' => '377.0_2' [24], '0.0' => '0.0_4' [25], '0.0' => '0.0_5' [28],
## '0.0' => '0.0_6' [30], '0.0' => '0.0_7' [33], '0.0' => '0.0_8' [35], '0.0'
## => '0.0_9' [38], '9.0' => '9.0_1' [39], '0.0' => '0.0_10' [40], '0.0'
## => '0.0_11' [43], '0.0' => '0.0_12' [45], '9.0' => '9.0_2' [49], '0.0'
## => '0.0_13' [50], '2.0' => '2.0_1' [51], '2.0' => '2.0_2' [52], '0.0'
## => '0.0_14' [53], '2.0' => '2.0_3' [54], '2.0' => '2.0_4' [55], '0.0' =>
## '0.0_15' [56], '0.0' => '0.0_16' [57], '0.0' => '0.0_17' [58], '0.0' =>
## '0.0_18' [59], '0.0' => '0.0_19' [60], '10.0' => '10.0_1' [61], '0.0' => ## '0.0_20' [62], '0.0' => '0.0_21' [63],
'0.0' => '0.0_22' [64], '0.0' =>
## '0.0_23' [65], '0.0' => '0.0_24' [66], '0.0' => '0.0_25' [67], '0.0' =>
## '0.0_26' [68], '0.0' => '0.0_27' [69], '0.0' => '0.0_28' [70], '0.0' =>
## '0.0_29' [71], '0.0' => '0.0_30' [72], '0.0' => '0.0_31' [73], '0.0' =>
## '0.0_32' [74], '0.0' => '0.0_33' [75], '0.0' => '0.0_34' [76], '0.0' =>
## '0.0_35' [77], '0.0' => '0.0_36' [78], '0.0' => '0.0_37' [79], '0.0' =>
## '0.0_38' [80], '0.0' => '0.0_39' [81], '0.0' => '0.0_40' [82], '0.0' =>
## '0.0_41' [83], '0.0' => '0.0_42' [84], '0.0' => '0.0_43' [85], '0.0' =>
## '0.0_44' [86], '0.0' => '0.0_45' [87], '0.0' => '0.0_46' [88], '0.0' =>
## '0.0_47' [89], '0.0' => '0.0_48' [90], '0.0' => '0.0_49' [91], '0.0' =>
## '0.0_50' [92], '0.0' => '0.0_51' [93], '0.0' => '0.0_52' [94], '0.0' =>
## '0.0_53' [95], '0.0' => '0.0_54' [96], '0.0' => '0.0_55' [97], '0.0' =>
## '0.0_56' [98], '0.0' => '0.0_57' [99], '0.0' => '0.0_58' [100], '0.0' =>
## '0.0_59' [101], '0.0' => '0.0_60' [102], '0.0' => '0.0_61' [103], '0.0' =>
## '0.0_62' [104], '0.0' => '0.0_63' [105], '0.0' => '0.0_64' [106], '0.0' =>
## '0.0_65' [107], '0.0' => '0.0_66' [108], '0.0' => '0.0_67' [109], '0.0' =>
## '0.0_68' [110], '0.0' => '0.0_69' [111], '0.0' => '0.0_70' [112], '0.0' =>
## '0.0_71' [113], '0.0' => '0.0_72' [114], '0.0' => '0.0_73' [115], '0.0' =>
## '0.0_74' [116], '0.0' => '0.0_75' [117], '0.0' => '0.0_76' [118], '0.0' =>
## '0.0_77' [119], '0.0' => '0.0_78' [120], '0.0' => '0.0_79' [121], '0.0' =>
## '0.0_80' [122], '0.0' => '0.0_81' [123], '0.0' => '0.0_82' [124], '0.0' =>
## '0.0_83' [125], '0.0' => '0.0_84' [126], '0.0' => '0.0_85' [127], '0.0' =>
## '0.0_86' [128], '0.0' => '0.0_87' [129], '0.0' => '0.0_88' [130], '0.0' =>
## '0.0_89' [131], '0.0' => '0.0_90' [132], '0.0' => '0.0_91' [133], '0.0' =>
## '0.0_92' [134], '0.0' => '0.0_93' [135], '0.0' => '0.0_94' [136], '0.0' =>
## '0.0_95' [137], '0.0' => '0.0_96' [138], '0.0' => '0.0_97' [139], '0.0' =>
## '0.0_98' [140], '0.0' => '0.0_99' [141], '0.0' => '0.0_100' [142], '0.0' =
>
## '0.0_101' [143], '0.0' => '0.0_102' [144], '0.0' => '0.0_103' [145], '0.0'
## => '0.0_104' [146], '0.0' => '0.0_105' [147], '0.0' => '0.0_106' [148],
## '0.0' => '0.0_107' [149], '0.0' => '0.0_108' [150], '0.0' =>
## '0.0_109' [151], '0.0' => '0.0_110' [152], '0.0' => '0.0_111' [153], '0.0'
## => '0.0_112' [154], '0.0' => '0.0_113' [155], '0.0' => '0.0_114' [156],
## '0.0' => '0.0_115' [157], '0.0' => '0.0_116' [158], '0.0' =>
## '0.0_117' [159], '0.0' => '0.0_118' [160], '0.0' => '0.0_119' [161], '0.0'
```

```
## => '0.0_120' [162], '0.0' => '0.0_121' [163], '0.0' => '0.0_122' [164],  
## '0.0' => '0.0_123' [165], '0.0' => '0.0_124' [166], '0.0' =>  
## '0.0_125' [167], '0.0' => '0.0_126' [168], '0.0' => '0.0_127' [169], '0.0'  
## => '0.0_128' [170], '0.0' => '0.0_129' [171], '0.0' => '0.0_130' [172],  
## '0.0' => '0.0_131' [173], '0.0' => '0.0_132' [174], '0.0' =>  
## '0.0_133' [175], '0.0' => '0.0_134' [176], '0.0' => '0.0_135' [177], '0.0'  
## => '0.0_136' [178], '0.0' => '0.0_137' [179], '0.0' => '0.0_138' [180], ## '0.0' => '0.0_139' [181], '0.0'  
=> '0.0_140' [182], '0.0' =>  
## '0.0_141' [183], '0.0' => '0.0_142' [184], '0.0' => '0.0_143' [185], '0.0'  
## => '0.0_144' [186], '0.0' => '0.0_145' [187], '0.0' => '0.0_146' [188], ## '0.0' => '0.0_147' [189], '0.0'  
=> '0.0_148' [190], '0.0' =>  
## '0.0_149' [191], '0.0' => '0.0_150' [192], '0.0' => '0.0_151' [193], '0.0'  
## => '0.0_152' [194], '0.0' => '0.0_153' [195], '0.0' => '0.0_154' [196],  
## '0.0' => '0.0_155' [197], '0.0' => '0.0_156' [198], '0.0' =>  
## '0.0_157' [199], '0.0' => '0.0_158' [200], '0.0' => '0.0_159' [201], '0.0'  
## => '0.0_160' [202], '0.0' => '0.0_161' [203], '0.0' => '0.0_162' [204],  
## '0.0' => '0.0_163' [205], '0.0' => '0.0_164' [206], '0.0' =>  
## '0.0_165' [207], '0.0' => '0.0_166' [208], '0.0' => '0.0_167' [209], '0.0'  
## => '0.0_168' [210], '0.0' => '0.0_169' [211], '0.0' => '0.0_170' [212],  
## '0.0' => '0.0_171' [213], '0.0' => '0.0_172' [214], '0.0' =>
```



```

## '0.0_173' [215], '0.0' => '0.0_174' [216], '0.0' => '0.0_175' [217], '0.0'
## => '0.0_176' [218], '0.0' => '0.0_177' [219], '0.0' => '0.0_178' [220],
## '0.0' => '0.0_179' [221], '0.0' => '0.0_180' [222], '0.0' =>
## '0.0_181' [223], '0.0' => '0.0_182' [224], '0.0' => '0.0_183' [225], '0.0'
## => '0.0_184' [226], '0.0' => '0.0_185' [227], '0.0' => '0.0_186' [228],
## '0.0' => '0.0_187' [229], '0.0' => '0.0_188' [230], '0.0' =>
## '0.0_189' [231], '0.0' => '0.0_190' [232], '0.0' => '0.0_191' [233], '0.0'
## => '0.0_192' [234], '0.0' => '0.0_193' [235], '0.0' => '0.0_194' [236], ## '0.0' => '0.0_195' [237], '0.0'
=> '0.0_196' [238], '0.0' =>
## '0.0_197' [239], '0.0' => '0.0_198' [240], '0.0' => '0.0_199' [241], '0.0'
## => '0.0_200' [242], '0.0' => '0.0_201' [243], '0.0' => '0.0_202' [244],
## '0.0' => '0.0_203' [245], '0.0' => '0.0_204' [246], '0.0' =>
## '0.0_205' [247], '0.0' => '0.0_206' [248], '0.0' => '0.0_207' [249], '0.0'
## => '0.0_208' [250], '0.0' => '0.0_209' [251], '0.0' => '0.0_210' [252],
## '0.0' => '0.0_211' [253], '0.0' => '0.0_212' [254], '0.0' =>
## '0.0_213' [255], '0.0' => '0.0_214' [256], '0.0' => '0.0_215' [257], '0.0'
## => '0.0_216' [258], '0.0' => '0.0_217' [259], '0.0' => '0.0_218' [260],
## '0.0' => '0.0_219' [261], '0.0' => '0.0_220' [262], '0.0' =>
## '0.0_221' [263], '0.0' => '0.0_222' [264], '0.0' => '0.0_223' [265], '0.0'
## => '0.0_224' [266], '0.0' => '0.0_225' [268], '0.0' => '0.0_226' [269],
## '0.0' => '0.0_227' [270], '0.0' => '0.0_228' [271], '0.0' =>
## '0.0_229' [272], '1.0' => '1.0_1' [273], '0.0' => '0.0_230' [274], '0.0' =
>
## '0.0_231' [275], '0.0' => '0.0_232' [276], '0.0' => '0.0_233' [277], '0.0'
## => '0.0_234' [278], '0.0' => '0.0_235' [279], '0.0' => '0.0_236' [280], ## '1.0' => '1.0_2' [281]

```

## Parsed with column specification:

```

## cols(
##   .default = col_double() ## )

```

## See spec(...) for full column specifications.

**View**(blogData\_train)

```

# retrieve filenames of test sets
test_filenames = list.files(pattern = "blogData_test")

# load and combine dataset   train =
fread("blogData_train.csv")
test = foreach(i = 1:length(test_filenames), .combine = rbind) %do% {   temp =
fread(test_filenames[i], header = F)   }

# log-transform   train[, V281 := log(1 +
V281)]   test[, V281 := log(1 + V281)]

```

*# drop continous variables without variation*

```
drop = c(8, 13, 28, 33, 38, 40,  
43, 50, 278)
```

```

train[,
(drop)      :=
NULL] test[,
(drop)      :=
NULL]

```

```

row.names = F) row.names = F)

```

```

# write to files
write.csv(train, "BlogFeedback-
Train.csv", write.csv(test,
"BlogFeedback-Test.csv", train

```

```

04423

```

```

##      V1    V2 V3 V4 V5
V6    V7 V9 V10  V11
##  1: 40.30467 53.84566 0
401 15 15.52416 32.44188 377
3 14.04423

```

```

0000

```

```

##  2: 40.30467 53.84566 0
401 15 15.52416 32.44188 377
3 14.
##  3: 40.30467 53.84566 0
401 15 15.52416 32.44188 377
3 14.04423

```

```

56757 48.47518 0 378 12 1.479934 46.18691

```

```

##  4: 40.30467 53.84566 0
401 15 15.52416 32.44188 377
3 14.04423
##  5: 40.30467 53.84566 0 401
15 15.52416 32.44188 377 3
14.04423 ## ---

```

```

9934 46.18691

```

```

## 52393: 33.00000 0.00000 33 33 33 33 0.000000 26.94439
33 33 11.00000 15.55635 33 0
11.00000

```

```

## 52394: 33.00000 0.00000 33 0 0 0.000000 0.00000
33 33 11.00000 15.55635 33 0
11.00000 ## 52395: 0.00000
0.00000 0 0 0 0.00000 0.00000
0 0 0.0

```

```

0

```

```

0

```

```

0

```

```

0

```

```

## 52396: 0.00000 0.00000 0
0 0 0.00000 0.00000 0 0
0.00000

```

```

0

```

```

## 52397: 0.00000 0.00000 0
0 0 0.00000 0.00000 0 0
0.00000

```

```

0

```

```

0 0.6666667 0.9428091 2 0

```

```

##      V12 V14 V15  V16
V17 V18 V19 V20  V21  V22
##  1: 32.61542 377 2 34.

```

```

0 0.02293202

```

```

## 2: 32.61542 377 2
34.56757 48.47518 0 378 12
1.479934 46.18691
## 3: 32.61542 377 2
34.56757 48.47518 0 378 12
1.479934 46.18691
## 4: 32.61542 377 2
34.56757 48.47518 0 378 12
1.47
## 5: 32.61542 377 2 34.56757
48.47518 0 378 12 1.479934
46.18691 ## --
## 52393: 15.55635 33 0
33.00000 0.00000 33 33 33
0.000000 26.94439
## 52394: 15.55635 33 0
33.00000 0.00000
## 52395: 0.00000 0 0
0.00000 0.00000 0 0 0
0.000000 0.00000
## 52396: 0.00000 0 0
0.00000 0.00000 0 0 0
0.000000 0.00000
## 52397: 0.00000 0 0 0.00000
0.00000 0
## V23 V24 V25 V26
V27 V29 V30 V31 V32 V34
V35
## 1: -356 377 0 1.076167
1.795416 11 0 0.4004914
1.0780969 9
## 2: -356 377 0 1.076167
1.795416 11 0 0.4004914
1.0780969 9
## 3: -356 377 0 1.076167
1.795416 11 0 0.4004914
1.0780969 9
## 4: -356 377 0 1.076167
1.795416 11 0 0.4004914
1.0780969 9 ## 5: -356 377
0 1.076167 1.795416 11 0
0.4004914 1.0780969 9 ## --
-
## 52393: -33 33 0 0.000000
0.000000 0 0 0.0000000
0.0000000 0

```

```
## 52394: -33 33 0 0.000000
0.000000 0 0 0.000000
0.000000 0
## 52395: 0 0 0 2.000000
0.000000 2 2
## 52396: 0 0 0 2.000000
0.000000 2 2 0.6666667
0.9428091 2 0
## 52397: 0 0 0 2.000000
0.000000 2 2 0.6666667
0.9428091 2 0
##      V36      V37 V39
V41      V42 V44 V45      V46
## 1: 0.3775594 1.0742100 9
0.972973 1.704671 10
## 2: 0.3775594 1.0742100 9
0.972973 1.704671 10 0
0.02293202
## 3: 0.3775594 1.0742100 9
0.972973 1.704671 10 0
0.02293202
```

```
## 4: 0.3775594 1.0742100 9 0.972973 1.704671 10 0 0.02293202
```

```

## 5: 0.3775594 1.0742100 9 0.972973 1.704671 10 0 0.02293202
## ---
## 52393: 0.0000000 0.0000000 0 0.000000 0.000000 0 0 0.00000000
## 52394: 0.0000000 0.0000000 0 0.000000 0.000000 0 0 0.00000000
## 52395: 0.6666667 0.9428091 2 2.000000 0.000000 2 2 0.00000000
## 52396: 0.6666667 0.9428091 2 2.000000 0.000000 2 2 0.00000000
## 52397: 0.6666667 0.9428091 2 2.000000 0.000000 2 2 0.00000000
##      V47 V48 V49 V51 V52 V53 V54 V55 V56 V57 V58 V59 V60 V61 V62
## 1: 1.521174 -8 9 2 2 0 2 2 0 0 0 0 0 10 0
## 2: 1.521174 -8 9 6 2 4 5 -2 0 0 0 0 0 35 0
## 3: 1.521174 -8 9 6 2 4 5 -2 0 0 0 0 0 35 0
## 4: 1.521174 -8 9 2 2 0 2 2 0 0 0 0 0 10 0
## 5: 1.521174 -8 9 3 1 2 2 -1 0 0 0 0 0 34 0
## ---
## 52393: 0.000000 0 0 33 0 33 33 -33 0 0 0 0 0 38 3137
## 52394: 0.000000 0 0 33 0 0 33 0 0 0 0 0 0 62 3137
## 52395: 1.632993 -2 2 0 0 0 0 0 2 2 0 2 2 13 0
## 52396: 1.632993 -2 2 0 0 0 0 0 2 0 2 2 -2 37 0
## 52397: 1.632993 -2 2 0 0 0 0 0 2 0 0 2 0 61 0
##      V63 V64 V65 V66 V67 V68 V69 V70 V71 V72 V73 V74 V75 V76 V77 V78 V79
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
## 52394: 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V80 V81 V82 V83 V84 V85 V86 V87 V88 V89 V90 V91 V92 V93 V94 V95 V96
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

```

## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

## V97 V98 V99 V100 V101 V102 V103 V104 V105 V106 V107 V108 V109 V110

## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

```

## ---
## 52393: 0 0 0 0 1 0 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 1 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V111 V112 V113 V114 V115 V116 V117 V118 V119 V120 V121 V122 V123
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V124 V125 V126 V127 V128 V129 V130 V131 V132 V133 V134 V135 V136
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V137 V138 V139 V140 V141 V142 V143 V144 V145 V146 V147 V148 V149
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 1 0 0 0 0 1 0 0 0 0 0 0
## 52394: 0 1 0 0 0 0 1 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0

```



```
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V150 V151 V152 V153 V154 V155 V156 V157 V158 V159 V160 V161 V162
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 ## 52394: 0 0 0 0 0 0 0 0 0 0 0 0
0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V163 V164 V165 V166 V167 V168 V169 V170 V171 V172 V173 V174 V175
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V176 V177 V178 V179 V180 V181 V182 V183 V184 V185 V186 V187 V188
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 1 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 0 1 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V189 V190 V191 V192 V193 V194 V195 V196 V197 V198 V199 V200 V201
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

```
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## V202 V203 V204 V205 V206 V207 V208 V209 V210 V211 V212 V213 V214
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 ## 52396: 0 0 0 0 0 0 0 0 0 0 0 0
0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## V215 V216 V217 V218 V219 V220 V221 V222 V223 V224 V225 V226 V227
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0
## V228 V229 V230 V231 V232 V233 V234 V235 V236 V237 V238 V239 V240
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0
```

```

## ---
## 52393: 1 0 0 0 1 0 0 0 0 0 0 0 0 0
## 52394: 1 0 0 0 1 0 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V241 V242 V243 V244 V245 V246 V247 V248 V249 V250 V251 V252 V253
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 1 0 0 0 0 0 0 0 0
## 52394: 0 0 0 0 0 1 0 0 0 0 0 0 0 0
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V254 V255 V256 V257 V258 V259 V260 V261 V262 V263 V264 V265 V266
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## 52394: 0 0 0 0 0 0 0 0 0 0 0 0 0 1
## 52395: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52396: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 52397: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 ##      V267 V268 V269 V270 V271 V272 V273
V274 V275 V276 V277 V279 V280
## 1: 1 0 0 0 0 0 1 0 0 0 0 0 0 0
## 2: 1 0 0 0 0 1 0 0 0 0 0 0 0 0
## 3: 1 0 0 0 0 1 0 0 0 0 0 0 0 0
## 4: 1 0 0 0 0 0 1 0 0 0 0 0 0 0
## 5: 0 1 0 0 0 0 1 0 0 0 0 0 0 0
## ---
## 52393: 0 0 0 1 0 0 0 0 0 0 0 0 0 0
## 52394: 0 0 0 1 0 0 0 0 0 0 0 0 0 0
## 52395: 1 0 0 0 0 0 1 0 0 0 0 0 0 0

```

```
## 52396: 0 1 0 0 0 0 1 0 0 0 0 0 0 ## 52397: 0 0 1 0 0 0 1 0 0 0
0 0 0
```

```
##      V281
```

```
## 1: 0.6931472
```

```
## 2: 0.0000000
```

```
## 3: 0.0000000
```

```
## 4: 0.6931472
```

```
## 5: 3.3322045
```

```
## ---
```

```
## 52393: 0.0000000
```

```
## 52394: 0.0000000
```

```
## 52395: 0.0000000
```

```
## 52396: 0.0000000 ##
```

```
52397: 0.0000000 test
```

```
##      V1      V2 V3 V4 V5      V6      V7 V9 V10
```

```
## 1: 10.630660 17.882992 1 259 5.0 4.0182760 10.39679 235 1.0
```

```
## 2: 43.435825 75.590485 0 634 20.0 15.9985895 44.56087 473 2.0
```

```
## 3: 1.733333 3.043390 0 9 0.0 0.7333333 1.52607 5 0.0
```

```
## 4: 27.230215 45.970950 0 371 14.0 10.7841730 24.20994 228 4.0
```

```
## 5: 4.500000 6.677075 0 18 0.5 3.0000000 4.00000 10 0.5
```

```
## ---
```

```
## 7620: 0.000000 0.000000 0 0 0.0 0.0000000 0.00000 0 0.0
```

```
## 7621: 56.512093 77.442830 0 438 32.0 19.2965300 49.22134 432 0.0
```

```
## 7622: 49.442368 112.620125 1 849 9.0 20.4454820 62.61939 506 2.0
```

```
## 7623: 16.593575 19.671364 1 144 10.0 6.5124497 11.05121 111 2.0
```

```
## 7624: 0.000000 0.000000 0 0 0.0 0.0000000 0.00000 0 0.0
```

```
##      V11      V12 V14 V15      V16      V17 V18 V19 V20
```

```
## 1: 3.8172395 10.297346 235 1 9.776869 16.073494 1 192 5.0
```

```
## 2: 15.4696760 44.685085 473 1 40.971790 70.307840 0 479 18.0
```

```
## 3: 0.6666667 1.534782 5 0 1.133333 1.820867 0 5 0.0
```

```
## 4: 9.9976015 24.400290 228 2 22.563549 39.761290 0 337 10.0
```

```
## 5: 1.3333334 2.560382 7 0 2.833333 3.670453 0 8 0.5
```

```
## ---
```

```
## 7620: 0.0000000 0.000000 0 0 0.000000 0.000000 0 0 0.0
```

```
## 7621: 18.9663500 49.304424 432 0 55.904312 76.864080 0 438 31.0
```

```
## 7622: 19.2211840 62.536453 506 1 38.274143 85.508520 1 574 7.0
```

```
## 7623: 5.8257027 11.001102 111 1 13.765462 15.641400 1 112 9.0
```

```
## 7624: 0.0000000 0.000000 0 0 0.000000 0.000000 0 0 0.0
```

```
##      V21      V22 V23 V24 V25      V26      V27 V29 V30
```

```
## 1: 0.20103656 13.948867 -229 217 0.0 0.25177306 0.9038038 14 0
```

```
## 2: 0.52891400 62.134968 -461 473 0.0 0.19322990 0.4576994 2 0
```

```

## 3: 0.06666667 1.730767 -5 4 0.0 0.33333334 0.6992059 2 0
## 4: 0.78657070 30.358133 -156 228 0.0 0.11031175 0.3562584 2 0
## 5: 1.66666660 2.211083 0 6 0.5 0.00000000 0.0000000 0 0
## ---
## 7620: 0.00000000 0.000000 0 0 0.0 0.00000000 0.0000000 0 0
## 7621: 0.33017877 72.227750 -426 432 0.0 0.00000000 0.0000000 0 0
## 7622: 1.22429910 78.975365 -474 506 0.0 1.07476640 2.2341206 16 0
## 7623: 0.68674700 14.777326 -104 111 0.0 0.01526104 0.1350592 2 0
## 7624: 0.00000000 0.000000 0 0 0.0 0.00000000 0.0000000 0 0
##      V31      V32 V34 V35      V36      V37 V39      V41
## 1: 0.09438080 0.50673160 12 0 0.09192581 0.50421600 12 0.23349700
## 2: 0.07334273 0.28647503 2 0 0.06770099 0.27788836 2 0.17630465
## 3: 0.13333334 0.33993465 1 0 0.13333334 0.33993465 1 0.20000000
## 4: 0.04316547 0.21470532 2 0 0.04076739 0.20952702 2 0.09832134
## 5: 0.00000000 0.00000000 0 0 0.00000000 0.00000000 0 0.00000000
## ---
## 7620: 0.00000000 0.00000000 0 0 0.00000000 0.00000000 0 0.00000000
## 7621: 0.00000000 0.00000000 0 0 0.00000000 0.00000000 0 0.00000000
## 7622: 0.42679128 1.34016500 13 0 0.40809968 1.33201530 13 0.95015574
## 7623: 0.00562249 0.08483692 2 0 0.00562249 0.08483692 2 0.01526104
## 7624: 0.00000000 0.00000000 0 0 0.00000000 0.00000000 0 0.00000000
##      V42 V44 V45      V46      V47 V48 V49 V51 V52 V53 V54 V55
## 1: 0.8547111 13 0 0.002454992 0.6747285 -10 12 35 35 0 35 35
## 2: 0.4297832 2 0 0.005641749 0.4044489 -2 2 21 0 2 21 -2
## 3: 0.4000000 1 0 0.000000000 0.3651484 -1 1 2 2 0 2 2
## 4: 0.3210027 2 0 0.002398082 0.2897018 -2 2 3 3 0 3 3
## 5: 0.0000000 0 0 0.000000000 0.0000000 0 0 0 0 0 0 0
## ---
## 7620: 0.0000000 0 0 0.000000000 0.0000000 0 0 1 1 0 0 1
## 7621: 0.0000000 0 0 0.000000000 0.0000000 0 0 2 1 1 1 0
## 7622: 1.9263725 14 0 0.018691588 1.7894533 -11 13 3 1 0 2 1
## 7623: 0.1350592 2 0 0.000000000 0.1202407 -2 2 8 8 0 8 8
## 7624: 0.0000000 0 0 0.000000000 0.0000000 0 0 1 1 0 1 1
##      V56 V57 V58 V59 V60 V61 V62 V63 V64 V65 V66 V67 V68 V69 V70 V71 V72
## 1: 0 0 0 0 0 9 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 62 696 0 0 0 0 0 1 0 0 0 0
## 3: 2 2 0 2 2 13 8361 0 1 0 0 1 1 1 0 0 0
## 4: 0 0 0 0 0 9 2751 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 5 187 0 0 0 0 0 0 0 0 0 0
## ---

```

```

## 7620: 0 0 0 0 0 0 64 1478 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 47 4196 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 63 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 14 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 9 0 0 0 0 0 0 0 0 0 0
## V73 V74 V75 V76 V77 V78 V79 V80 V81 V82 V83 V84 V85 V86 V87 V88 V89 ## 1: 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## V90 V91 V92 V93 V94 V95 V96 V97 V98 V99 V100 V101 V102 V103 V104
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
## 3: 0 0 0 0 0 0 1 0 0 0 0 1 1 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## V105 V106 V107 V108 V109 V110 V111 V112 V113 V114 V115 V116 V117
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0

```

```
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V118 V119 V120 V121 V122 V123 V124 V125 V126 V127 V128 V129 V130
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 1 0 1 0 0 0 0 0 0 0 0 0
## 4: 0 1 0 0 1 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 1 0 0 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V131 V132 V133 V134 V135 V136 V137 V138 V139 V140 V141 V142 V143
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 1 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 0 1
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 1
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 1
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 1 0 0 0 1
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V144 V145 V146 V147 V148 V149 V150 V151 V152 V153 V154 V155 V156
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 1 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 1 0 1 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V157 V158 V159 V160 V161 V162 V163 V164 V165 V166 V167 V168 V169
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0
```

```

## 3: 0 1 1 0 0 0 0 0 0 0 0 0 0 0
## 4: 0 1 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 1 0 0 0 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## V170 V171 V172 V173 V174 V175 V176 V177 V178 V179 V180 V181 V182
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 1 0 0 0 0 0 0 0 0 0 0 1 1 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## V183 V184 V185 V186 V187 V188 V189 V190 V191 V192 V193 V194 V195
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 0 0 1 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 0 0 0 1 1 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## V196 V197 V198 V199 V200 V201 V202 V203 V204 V205 V206 V207 V208
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 0 0 1 0 0 0 0 1 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0

```



```

## 7621: 0 1 0 0 0 0 1 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V209 V210 V211 V212 V213 V214 V215 V216 V217 V218 V219 V220 V221
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 0 1 0 0 1 0 0 0 0 0 0 0 0 0
## 4: 0 0 0 0 1 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 1 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V222 V223 V224 V225 V226 V227 V228 V229 V230 V231 V232 V233 V234
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 1 0 0 0 0 0 1 0 0 0
## 3: 0 0 0 0 1 0 1 0 0 0 1 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 1 0 1 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V235 V236 V237 V238 V239 V240 V241 V242 V243 V244 V245 V246 V247
## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 1 0
## 3: 0 0 0 0 0 0 0 0 0 0 0 1 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 1 1
## 5: 0 0 0 0 0 0 0 0 0 0 0 1 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 0 0 0 1 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V248 V249 V250 V251 V252 V253 V254 V255 V256 V257 V258 V259 V260

```

```

## 1: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 2: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 3: 1 0 0 0 0 0 1 0 0 0 0 0 0 0
## 4: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ---
## 7620: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7621: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7622: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7623: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 7624: 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##      V261 V262 V263 V264 V265 V266 V267 V268 V269 V270 V271 V272 V273
## 1: 0 0 0 0 1 0 0 0 0 0 1 0 0
## 2: 0 0 0 0 1 0 0 0 0 0 0 0 0
## 3: 0 0 0 0 1 0 0 0 0 0 1 0 0
## 4: 0 0 0 0 1 0 0 0 0 0 1 0 0
## 5: 0 0 0 0 1 0 0 0 0 0 1 0 0
## ---
## 7620: 0 0 0 0 0 0 0 1 0 0 0 1 0
## 7621: 0 0 0 0 0 0 0 1 0 0 0 0 1
## 7622: 0 0 0 0 0 0 0 1 0 0 0 1 0
## 7623: 0 0 0 0 0 0 0 1 0 0 0 0 0 ## 7624: 0 0 0 0 0 0 0 1 0 0 0
0 0
##      V274 V275 V276 V277 V279 V280      V281
## 1: 0 0 0 0 0 0 0 1.6094379
## 2: 0 0 1 0 0 0 0.0000000
## 3: 0 0 0 0 0 0 0.6931472
## 4: 0 0 0 0 0 0 1.7917595
## 5: 0 0 0 0 0 0 0.0000000
## ---
## 7620: 0 0 0 0 0 0 0.0000000
## 7621: 0 0 0 0 0 0 0.0000000
## 7622: 0 0 0 0 0 0 0.0000000
## 7623: 1 0 0 0 0 0 1.3862944
## 7624: 1 0 0 0 0 0 0.0000000

### Basic Models ### library(data.table)
library(MatrixModels)

library(e1071) library(FNN)
library(glmnet)

```

```

## Loading required package: Matrix

## Loaded glmnet 2.0-16

library(ranger) library(xgboost)

# load and combine dataset
train = fread("BlogFeedback-Train.csv") test =
fread("BlogFeedback-Test.csv")

# error measure
mse = function(y_hat, y) { mse =
mean((y - y_hat)^2)
return(mse)
}

# create design matrices
train_x = model.Matrix(V281 ~ . - 1, data = train, sparse = F) train_x_sparse = model.Matrix(V281 ~ . -
1, data = train, sparse = T) train_y = train$V281

test_x = model.Matrix(V281 ~ . - 1, data = test, sparse = F) test_y = test$V281

train_xgb = xgb.DMatrix(data = as.matrix(train_x), label = train_y) test_xgb = xgb.DMatrix(data =
as.matrix(test_x), label = test_y)

# try kNN
pred_knn = knn.reg(train_x, test_x, train_y, k = 19)$pred mse(pred_knn, test_y)

## [1] 0.6383154

# try LASSO
mdl_lasso = cv.glmnet(train_x_sparse, train_y, family = "gaussian", alpha = 1
)
pred_lasso = predict(mdl_lasso, newx = test_x) mse(pred_lasso, test_y)

## [1] 0.6365795

# try random forest
mdl_rf = ranger(V281 ~ ., data = train, num.trees = 1000, mtry = 120, write.forest = T)

## Growing trees.. Progress: 3%. Estimated remaining time: 21 minutes, 27 sec onds.
## Growing trees.. Progress: 5%. Estimated remaining time: 19 minutes, 39 sec onds.
## Growing trees.. Progress: 8%. Estimated remaining time: 18 minutes, 54 sec
onds.
## Growing trees.. Progress: 11%. Estimated remaining time: 18 minutes, 7 sec onds.
## Growing trees.. Progress: 14%. Estimated remaining time: 17 minutes, 19 se conds.
## Growing trees.. Progress: 17%. Estimated remaining time: 16 minutes, 36 se conds.

```

```

## Growing trees.. Progress: 19%. Estimated remaining time: 16 minutes, 1 sec onds.
## Growing trees.. Progress: 22%. Estimated remaining time: 15 minutes, 27 se conds.
## Growing trees.. Progress: 25%. Estimated remaining time: 14 minutes, 51 se conds.
## Growing trees.. Progress: 28%. Estimated remaining time: 14 minutes, 17 se conds.
## Growing trees.. Progress: 30%. Estimated remaining time: 13 minutes, 41 se conds.
## Growing trees.. Progress: 33%. Estimated remaining time: 13 minutes, 8 sec onds.
## Growing trees.. Progress: 36%. Estimated remaining time: 12 minutes, 35 se conds.
## Growing trees.. Progress: 39%. Estimated remaining time: 12 minutes, 2 sec onds.
## Growing trees.. Progress: 42%. Estimated remaining time: 11 minutes, 29 se conds.
## Growing trees.. Progress: 44%. Estimated remaining time: 10 minutes, 57 se conds.
## Growing trees.. Progress: 47%. Estimated remaining time: 10 minutes, 25 se conds.
## Growing trees.. Progress: 49%. Estimated remaining time: 10 minutes, 4 sec onds.
## Growing trees.. Progress: 52%. Estimated remaining time: 9 minutes, 45 sec onds.
## Growing trees.. Progress: 54%. Estimated remaining time: 9 minutes, 19 sec onds.
## Growing trees.. Progress: 57%. Estimated remaining time: 8 minutes, 44 sec onds.
## Growing trees.. Progress: 59%. Estimated remaining time: 8 minutes, 11 sec onds.
## Growing trees.. Progress: 62%. Estimated remaining time: 7 minutes, 41 sec onds.
## Growing trees.. Progress: 65%. Estimated remaining time: 7 minutes, 7 seco nds.
## Growing trees.. Progress: 67%. Estimated remaining time: 6 minutes, 39 sec onds.
## Growing trees.. Progress: 70%. Estimated remaining time: 6 minutes, 11 sec onds.
## Growing trees.. Progress: 72%. Estimated remaining time: 5 minutes, 38 sec
onds.
## Growing trees.. Progress: 75%. Estimated remaining time: 5 minutes, 3 seco
nds.
## Growing trees.. Progress: 78%. Estimated remaining time: 4 minutes, 29 sec onds.
## Growing trees.. Progress: 80%. Estimated remaining time: 3 minutes, 59 sec onds.
## Growing trees.. Progress: 83%. Estimated remaining time: 3 minutes, 26 sec onds.
## Growing trees.. Progress: 86%. Estimated remaining time: 2 minutes, 52 sec onds.
## Growing trees.. Progress: 89%. Estimated remaining time: 2 minutes, 18 sec onds.
## Growing trees.. Progress: 91%. Estimated remaining time: 1 minute, 44 seco nds.
## Growing trees.. Progress: 94%. Estimated remaining time: 1 minute, 10 seco nds.
## Growing trees.. Progress: 97%. Estimated remaining time: 36 seconds. ## Growing trees..
Progress: 100%. Estimated remaining time: 2 seconds.

```

```

pred_rf = predict(mdl_rf, test) mse(pred_rf$predictions, test_y)

```

```

## [1] 0.397223

```

```

# try SVM

```

```

mdl_svm = svm(V281 ~ V52 + V55 + V61 + V51 + V54 + V21 + V6 + V10, data = tra in, kernel = "radial",
cost = 2, gamma = 0.25) pred_svm = predict(mdl_svm, test) mse(pred_svm, test_y)

```

```
## [1] 0.4454636
```

```
# try XGboost
```

```
mdl_xgb = xgboost(data = train_xgb, nround = 750, nthread = 4, max_depth = 6, eta = 0.025, subsample = 0.7, gamma = 3)
```

```
## [1] train-rmse:1.123211  
## [2] train-rmse:1.105587  
## [3] train-rmse:1.088751  
## [4] train-rmse:1.072364  
## [5] train-rmse:1.056541  
## [6] train-rmse:1.041299  
## [7] train-rmse:1.026474  
## [8] train-rmse:1.012151  
## [9] train-rmse:0.998236  
## [10] train-rmse:0.984944  
## [11] train-rmse:0.972046  
## [12] train-rmse:0.959660  
## [13] train-rmse:0.947695  
## [14] train-rmse:0.936049  
## [15] train-rmse:0.924799
```

## [16] train-rmse:0.913825  
## [17] train-rmse:0.903303  
## [18] train-rmse:0.893156  
## [19] train-rmse:0.883414  
## [20] train-rmse:0.874059  
## [21] train-rmse:0.865047  
## [22] train-rmse:0.856306  
## [23] train-rmse:0.848055  
## [24] train-rmse:0.840064  
## [25] train-rmse:0.832164  
## [26] train-rmse:0.824686  
## [27] train-rmse:0.817432  
## [28] train-rmse:0.810481  
## [29] train-rmse:0.803617  
## [30] train-rmse:0.797115  
## [31] train-rmse:0.790814  
## [32] train-rmse:0.784595  
## [33] train-rmse:0.778755  
## [34] train-rmse:0.773094  
## [35] train-rmse:0.767748  
## [36] train-rmse:0.762395  
## [37] train-rmse:0.757345  
## [38] train-rmse:0.752488  
## [39] train-rmse:0.747817  
## [40] train-rmse:0.743399  
## [41] train-rmse:0.739041  
## [42] train-rmse:0.734814

```
## [43] train-rmse:0.730827
## [44] train-rmse:0.726892
## [45] train-rmse:0.723121
## [46] train-rmse:0.719583
## [47] train-rmse:0.716088
## [48] train-rmse:0.712764
## [49] train-rmse:0.709580
## [50] train-rmse:0.706472
## [51] train-rmse:0.703511
## [52] train-rmse:0.700691
## [53] train-rmse:0.697894
## [54] train-rmse:0.695273
## [55] train-rmse:0.692620
## [56] train-rmse:0.690116
## [57] train-rmse:0.687650
## [58] train-rmse:0.685264
## [59] train-rmse:0.683066
## [60] train-rmse:0.680842
## [61] train-rmse:0.678713
## [62] train-rmse:0.676759
## [63] train-rmse:0.674839
## [64] train-rmse:0.672873
## [65] train-rmse:0.671013 ## [66] train-
rmse:0.669334
## [67] train-rmse:0.667636
## [68] train-rmse:0.665990
## [69] train-rmse:0.664497
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## [70] train-rmse:0.662978
## [71] train-rmse:0.661438
## [72] train-rmse:0.659984
## [73] train-rmse:0.658645
## [74] train-rmse:0.657361
## [75] train-rmse:0.656081
## [76] train-rmse:0.654839
## [77] train-rmse:0.653571
## [78] train-rmse:0.652382
## [79] train-rmse:0.651310
## [80] train-rmse:0.650165
## [81] train-rmse:0.649082
## [82] train-rmse:0.647973
## [83] train-rmse:0.646989
## [84] train-rmse:0.645910
## [85] train-rmse:0.644910
## [86] train-rmse:0.643895
## [87] train-rmse:0.642963
## [88] train-rmse:0.642045
## [89] train-rmse:0.641064
## [90] train-rmse:0.640266
## [91] train-rmse:0.639491
## [92] train-rmse:0.638624
## [93] train-rmse:0.637817
## [94] train-rmse:0.636958
## [95] train-rmse:0.636172
## [96] train-rmse:0.635401
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## [97] train-rmse:0.634687
## [98] train-rmse:0.633978
## [99] train-rmse:0.633370
## [100] train-rmse:0.632676
## [101] train-rmse:0.632104
## [102] train-rmse:0.631501
## [103] train-rmse:0.630874
## [104] train-rmse:0.630224
## [105] train-rmse:0.629601
## [106] train-rmse:0.628939
## [107] train-rmse:0.628386
## [108] train-rmse:0.627850
## [109] train-rmse:0.627310
## [110] train rmse:0.626764
## [111] train rmse:0.626267
## [112] train rmse:0.625726
## [113] train rmse:0.625219
## [114] train rmse:0.624769
## [115] train rmse:0.624165 ## [116]
train-rmse:0.623743
## [117] train-rmse:0.623251
## [118] train-rmse:0.622832
## [119] train-rmse:0.622405
## [120] train-rmse:0.621988
## [121] train-rmse:0.621555
## [122] train-rmse:0.621146
## [123] train-rmse:0.620705
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## [124] train-rmse:0.620241
## [125] train-rmse:0.619832
## [126] train-rmse:0.619472
## [127] train-rmse:0.619107
## [128] train-rmse:0.618744
## [129] train-rmse:0.618414
## [130] train-rmse:0.618085
## [131] train-rmse:0.617714
## [132] train-rmse:0.617314
## [133] train-rmse:0.616918
## [134] train-rmse:0.616511
## [135] train-rmse:0.616181
## [136] train-rmse:0.615858
## [137] train-rmse:0.615557
## [138] train-rmse:0.615228
## [139] train-rmse:0.614889
## [140] train-rmse:0.614607
## [141] train-rmse:0.614281
## [142] train-rmse:0.613947
## [143] train-rmse:0.613651
## [144] train-rmse:0.613283
## [145] train-rmse:0.612968
## [146] train-rmse:0.612614
## [147] train-rmse:0.612378
## [148] train-rmse:0.612145
## [149] train-rmse:0.611861
## [150] train-rmse:0.611578
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## [151] train-rmse:0.611311
## [152] train-rmse:0.611049
## [153] train-rmse:0.610834
## [154] train-rmse:0.610536
## [155] train-rmse:0.610197
## [156] train-rmse:0.609999
## [157] train-rmse:0.609664
## [158] train-rmse:0.609409
## [159] train-rmse:0.609206
## [160] train-rmse:0.608919
## [161] train-rmse:0.608690 ## [162]
train-rmse:0.608475 ## [163] train-
rmse:0.608148
## [164] train rmse:0.607911
## [165] train rmse:0.607605
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## [166] train rmse:0.607276  
## [167] train rmse:0.607037  
## [168] train rmse:0.606763  
## [169] train rmse:0.606605 ## [170]  
train-rmse:0.606398 ## [171] train-  
rmse:0.606151  
## [172] train-rmse:0.605972  
## [173] train-rmse:0.605751  
## [174] train-rmse:0.605503  
## [175] train-rmse:0.605364  
## [176] train-rmse:0.605119  
## [177] train-rmse:0.604999  
## [178] train-rmse:0.604829  
## [179] train-rmse:0.604616  
## [180] train-rmse:0.604328  
## [181] train-rmse:0.604144  
## [182] train-rmse:0.603980  
## [183] train-rmse:0.603702  
## [184] train-rmse:0.603520  
## [185] train-rmse:0.603301  
## [186] train-rmse:0.603089  
## [187] train-rmse:0.602896  
## [188] train-rmse:0.602779  
## [189] train-rmse:0.602619  
## [190] train-rmse:0.602334  
## [191] train-rmse:0.602113  
## [192] train-rmse:0.601964  
## [193] train-rmse:0.601723

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## [194] train-rmse:0.601552  
## [195] train-rmse:0.601356  
## [196] train-rmse:0.601204  
## [197] train-rmse:0.601073  
## [198] train-rmse:0.600908  
## [199] train-rmse:0.600630  
## [200] train-rmse:0.600489  
## [201] train-rmse:0.600313  
## [202] train-rmse:0.600121  
## [203] train-rmse:0.599887  
## [204] train-rmse:0.599679  
## [205] train-rmse:0.599521  
## [206] train-rmse:0.599354  
## [207] train-rmse:0.599247  
## [208] train-rmse:0.599107  
## [209] train-rmse:0.598965  
## [210] train rmse:0.598744  
## [211] train rmse:0.598487  
## [212] train rmse:0.598296  
## [213] train rmse:0.598070  
## [214] train rmse:0.597886  
## [215] train rmse:0.597762 ## [216]  
train rmse:0.597645  
## [217] train rmse:0.597460  
## [218] train rmse:0.597303  
## [219] train rmse:0.597139  
## [220] train rmse:0.596993

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## [221] train-rmse:0.596816  
## [222] train-rmse:0.596681  
## [223] train-rmse:0.596480  
## [224] train-rmse:0.596426  
## [225] train-rmse:0.596275  
## [226] train-rmse:0.596172  
## [227] train-rmse:0.595988  
## [228] train-rmse:0.595882  
## [229] train-rmse:0.595630  
## [230] train-rmse:0.595542  
## [231] train-rmse:0.595425  
## [232] train-rmse:0.595331  
## [233] train-rmse:0.595270  
## [234] train-rmse:0.595097  
## [235] train-rmse:0.594997  
## [236] train-rmse:0.594835  
## [237] train-rmse:0.594682  
## [238] train-rmse:0.594490  
## [239] train-rmse:0.594297  
## [240] train-rmse:0.594169  
## [241] train-rmse:0.594046  
## [242] train-rmse:0.593920  
## [243] train-rmse:0.593817  
## [244] train-rmse:0.593687  
## [245] train-rmse:0.593586  
## [246] train-rmse:0.593454  
## [247] train-rmse:0.593321

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## [248] train-rmse:0.593222  
## [249] train-rmse:0.593181  
## [250] train-rmse:0.592997  
## [251] train-rmse:0.592903  
## [252] train-rmse:0.592765  
## [253] train-rmse:0.592608  
## [254] train-rmse:0.592558  
## [255] train-rmse:0.592379  
## [256] train-rmse:0.592238  
## [257] train-rmse:0.592165  
## [258] train-rmse:0.592014  
## [259] train-rmse:0.591937  
## [260] train-rmse:0.591843  
## [261] train-rmse:0.591645  
## [262] train-rmse:0.591610 ## [263]  
train-rmse:0.591453 ## [264] train  
rmse:0.591344  
## [265] train rmse:0.591215 ## [266]  
train rmse:0.591102  
## [267] train rmse:0.590949  
## [268] train rmse:0.590880  
## [269] train rmse:0.590764  
## [270] train rmse:0.590543  
## [271] train-rmse:0.590363  
## [272] train-rmse:0.590315  
## [273] train-rmse:0.590080  
## [274] train-rmse:0.590054

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## [275] train-rmse:0.589934  
## [276] train-rmse:0.589857  
## [277] train-rmse:0.589768  
## [278] train-rmse:0.589655  
## [279] train-rmse:0.589459  
## [280] train-rmse:0.589386  
## [281] train-rmse:0.589320  
## [282] train-rmse:0.589181  
## [283] train-rmse:0.589132  
## [284] train-rmse:0.589030  
## [285] train-rmse:0.588961  
## [286] train-rmse:0.588802  
## [287] train-rmse:0.588653  
## [288] train-rmse:0.588475  
## [289] train-rmse:0.588426  
## [290] train-rmse:0.588306  
## [291] train-rmse:0.588197  
## [292] train-rmse:0.588082  
## [293] train-rmse:0.588006  
## [294] train-rmse:0.587925  
## [295] train-rmse:0.587716  
## [296] train-rmse:0.587591  
## [297] train-rmse:0.587550  
## [298] train-rmse:0.587409  
## [299] train-rmse:0.587306  
## [300] train-rmse:0.587163  
## [301] train-rmse:0.587017

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## [302] train-rmse:0.586815  
## [303] train-rmse:0.586702  
## [304] train-rmse:0.586673  
## [305] train-rmse:0.586496  
## [306] train-rmse:0.586417  
## [307] train-rmse:0.586257  
## [308] train rmse:0.586121  
## [309] train rmse:0.586019  
## [310] train rmse:0.585898  
## [311] train rmse:0.585771  
## [312] train rmse:0.585720  
## [313] train rmse:0.585694  
## [314] train rmse:0.585623  
## [315] train rmse:0.585546

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## [316] train rmse:0.585434  
## [317] train rmse:0.585341  
## [318] train rmse:0.585197  
## [319] train rmse:0.585064  
## [320] train rmse:0.584906  
## [321] train-rmse:0.584764  
## [322] train-rmse:0.584669  
## [323] train-rmse:0.584574  
## [324] train-rmse:0.584480  
## [325] train-rmse:0.584352  
## [326] train-rmse:0.584258  
## [327] train-rmse:0.584143  
## [328] train-rmse:0.584022  
## [329] train-rmse:0.583946  
## [330] train-rmse:0.583865  
## [331] train-rmse:0.583774  
## [332] train-rmse:0.583719  
## [333] train-rmse:0.583699  
## [334] train-rmse:0.583626  
## [335] train-rmse:0.583604  
## [336] train-rmse:0.583479  
## [337] train-rmse:0.583429  
## [338] train-rmse:0.583309  
## [339] train-rmse:0.583219  
## [340] train-rmse:0.583077  
## [341] train-rmse:0.583017  
## [342] train-rmse:0.582943

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## [343] train-rmse:0.582840  
## [344] train-rmse:0.582736  
## [345] train-rmse:0.582674  
## [346] train-rmse:0.582566  
## [347] train-rmse:0.582422  
## [348] train-rmse:0.582391  
## [349] train-rmse:0.582216  
## [350] train-rmse:0.582118  
## [351] train-rmse:0.581957  
## [352] train-rmse:0.581898  
## [353] train-rmse:0.581815  
## [354] train-rmse:0.581705  
## [355] train-rmse:0.581627  
## [356] train-rmse:0.581525  
## [357] train-rmse:0.581373  
## [358] train rmse:0.581311  
## [359] train rmse:0.581221  
## [360] train rmse:0.581165  
## [361] train rmse:0.581068  
## [362] train rmse:0.580975  
## [363] train-rmse:0.580781  
## [364] train rmse:0.580692  
## [365] train rmse:0.580597 ## [366]  
train rmse:0.580532  
## [367] train rmse:0.580456  
## [368] train rmse:0.580359  
## [369] train rmse:0.580331

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## [370] train rmse:0.580254  
## [371] train rmse:0.580146  
## [372] train-rmse:0.580111  
## [373] train-rmse:0.580012  
## [374] train-rmse:0.579900  
## [375] train-rmse:0.579844  
## [376] train-rmse:0.579720  
## [377] train-rmse:0.579586  
## [378] train-rmse:0.579516  
## [379] train-rmse:0.579450  
## [380] train-rmse:0.579348  
## [381] train-rmse:0.579222  
## [382] train-rmse:0.579168  
## [383] train-rmse:0.579048  
## [384] train-rmse:0.578874  
## [385] train-rmse:0.578801  
## [386] train-rmse:0.578768  
## [387] train-rmse:0.578689  
## [388] train-rmse:0.578618  
## [389] train-rmse:0.578392  
## [390] train-rmse:0.578252  
## [391] train-rmse:0.578165  
## [392] train-rmse:0.578061  
## [393] train-rmse:0.578029  
## [394] train-rmse:0.577999  
## [395] train-rmse:0.577939  
## [396] train-rmse:0.577862

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## [397] train-rmse:0.577771  
## [398] train-rmse:0.577677  
## [399] train-rmse:0.577659  
## [400] train-rmse:0.577577  
## [401] train-rmse:0.577495  
## [402] train-rmse:0.577423  
## [403] train-rmse:0.577302  
## [404] train-rmse:0.577277  
## [405] train-rmse:0.577195  
## [406] train-rmse:0.577108  
## [407] train-rmse:0.576930  
## [408] train rmse:0.576894  
## [409] train rmse:0.576704  
## [410] train rmse:0.576591  
## [411] train rmse:0.576478  
## [412] train rmse:0.576355  
## [413] train rmse:0.576223  
## [414] train rmse:0.576164  
## [415] train rmse:0.576025 ## [416]  
train rmse:0.575934  
## [417] train rmse:0.575787 ## [418]  
train-rmse:0.575667 ## [419] train-  
rmse:0.575629  
## [420] train-rmse:0.575554  
## [421] train-rmse:0.575457  
## [422] train-rmse:0.575337  
## [423] train-rmse:0.575294

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## [424] train-rmse:0.575159  
## [425] train-rmse:0.575129  
## [426] train-rmse:0.575080  
## [427] train-rmse:0.574957  
## [428] train-rmse:0.574844  
## [429] train-rmse:0.574693  
## [430] train-rmse:0.574661  
## [431] train-rmse:0.574566  
## [432] train-rmse:0.574498  
## [433] train-rmse:0.574464  
## [434] train-rmse:0.574339  
## [435] train-rmse:0.574178  
## [436] train-rmse:0.573983  
## [437] train-rmse:0.573906  
## [438] train-rmse:0.573833  
## [439] train-rmse:0.573796  
## [440] train-rmse:0.573760  
## [441] train-rmse:0.573682  
## [442] train-rmse:0.573672  
## [443] train-rmse:0.573636  
## [444] train-rmse:0.573617  
## [445] train-rmse:0.573511  
## [446] train-rmse:0.573419  
## [447] train-rmse:0.573375  
## [448] train-rmse:0.573367  
## [449] train-rmse:0.573174  
## [450] train-rmse:0.573073

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## [451] train-rmse:0.572968  
## [452] train-rmse:0.572944  
## [453] train-rmse:0.572868  
## [454] train-rmse:0.572804  
## [455] train-rmse:0.572663  
## [456] train-rmse:0.572548  
## [457] train-rmse:0.572497  
## [458] train-rmse:0.572488  
## [459] train-rmse:0.572454  
## [460] train-rmse:0.572387  
## [461] train-rmse:0.572279  
## [462] train-rmse:0.572225  
## [463] train-rmse:0.572164  
## [464] train-rmse:0.572049  
## [465] train-rmse:0.571998

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## [466] train rmse:0.571910  
## [467] train rmse:0.571850  
## [468] train rmse:0.571795  
## [469] train rmse:0.571724  
## [470] train rmse:0.571706  
## [471] train rmse:0.571653  
## [472] train rmse:0.571525  
## [473] train rmse:0.571452  
## [474] train-rmse:0.571361  
## [475] train-rmse:0.571296  
## [476] train-rmse:0.571231  
## [477] train-rmse:0.571131  
## [478] train-rmse:0.571033  
## [479] train-rmse:0.570871  
## [480] train-rmse:0.570778  
## [481] train-rmse:0.570702  
## [482] train-rmse:0.570683  
## [483] train-rmse:0.570646  
## [484] train-rmse:0.570574  
## [485] train-rmse:0.570507  
## [486] train-rmse:0.570464  
## [487] train-rmse:0.570412  
## [488] train-rmse:0.570293  
## [489] train-rmse:0.570253  
## [490] train-rmse:0.570198  
## [491] train-rmse:0.570159  
## [492] train-rmse:0.569999

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## [493] train-rmse:0.569918  
## [494] train-rmse:0.569878  
## [495] train-rmse:0.569785  
## [496] train-rmse:0.569762  
## [497] train-rmse:0.569638  
## [498] train-rmse:0.569563  
## [499] train-rmse:0.569455  
## [500] train-rmse:0.569361  
## [501] train-rmse:0.569276  
## [502] train-rmse:0.569145  
## [503] train-rmse:0.569077  
## [504] train-rmse:0.568910  
## [505] train-rmse:0.568881  
## [506] train-rmse:0.568771  
## [507] train-rmse:0.568645  
## [508] train-rmse:0.568599  
## [509] train-rmse:0.568498  
## [510] train-rmse:0.568325 ## [511]  
train-rmse:0.568307 ## [512] train  
rmse:0.568236  
## [513] train rmse:0.568184  
## [514] train rmse:0.568010  
## [515] train rmse:0.567941 ## [516]  
train rmse:0.567885  
## [517] train rmse:0.567806  
## [518] train rmse:0.567749 ## [519]  
train-rmse:0.567681 ## [520] train-  
rmse:0.567623

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## [521] train-rmse:0.567616  
## [522] train-rmse:0.567568  
## [523] train-rmse:0.567534  
## [524] train-rmse:0.567467  
## [525] train-rmse:0.567419  
## [526] train-rmse:0.567347  
## [527] train-rmse:0.567301  
## [528] train-rmse:0.567241  
## [529] train-rmse:0.567115  
## [530] train-rmse:0.566992  
## [531] train-rmse:0.566880  
## [532] train-rmse:0.566776  
## [533] train-rmse:0.566767  
## [534] train-rmse:0.566682  
## [535] train-rmse:0.566648  
## [536] train-rmse:0.566616  
## [537] train-rmse:0.566559  
## [538] train-rmse:0.566436  
## [539] train-rmse:0.566272  
## [540] train-rmse:0.566219  
## [541] train-rmse:0.566118  
## [542] train-rmse:0.566002  
## [543] train-rmse:0.565902  
## [544] train-rmse:0.565860  
## [545] train-rmse:0.565821  
## [546] train-rmse:0.565777  
## [547] train-rmse:0.565669  
## [548] train-rmse:0.565545

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## [549] train-rmse:0.565493  
## [550] train-rmse:0.565397  
## [551] train-rmse:0.565293  
## [552] train-rmse:0.565227  
## [553] train-rmse:0.565163  
## [554] train-rmse:0.565128  
## [555] train-rmse:0.565094  
## [556] train-rmse:0.565016  
## [557] train-rmse:0.564951  
## [558] train-rmse:0.564919  
## [559] train-rmse:0.564887  
## [560] train-rmse:0.564845  
## [561] train-rmse:0.564843  
## [562] train-rmse:0.564814  
## [563] train rmse:0.564748  
## [564] train rmse:0.564695  
## [565] train rmse:0.564633 ## [566]  
train rmse:0.564608  
## [567] train rmse:0.564497  
## [568] train rmse:0.564447  
## [569] train rmse:0.564351  
## [570] train rmse:0.564281  
## [571] train rmse:0.564208  
## [572] train rmse:0.564140  
## [573] train rmse:0.563984  
## [574] train-rmse:0.563906  
## [575] train-rmse:0.563906  
## [576] train-rmse:0.563770

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## [577] train-rmse:0.563611  
## [578] train-rmse:0.563554  
## [579] train-rmse:0.563479  
## [580] train-rmse:0.563369  
## [581] train-rmse:0.563289  
## [582] train-rmse:0.563202  
## [583] train-rmse:0.563183  
## [584] train-rmse:0.563166  
## [585] train-rmse:0.563067  
## [586] train-rmse:0.562960  
## [587] train-rmse:0.562906  
## [588] train-rmse:0.562832  
## [589] train-rmse:0.562766  
## [590] train-rmse:0.562666  
## [591] train-rmse:0.562583  
## [592] train-rmse:0.562487  
## [593] train-rmse:0.562445  
## [594] train-rmse:0.562371  
## [595] train-rmse:0.562295  
## [596] train-rmse:0.562152  
## [597] train-rmse:0.562133  
## [598] train-rmse:0.562080  
## [599] train-rmse:0.562019  
## [600] train-rmse:0.561969  
## [601] train-rmse:0.561853  
## [602] train-rmse:0.561769  
## [603] train-rmse:0.561704  
## [604] train-rmse:0.561692

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## [605] train-rmse:0.561538  
## [606] train-rmse:0.561490  
## [607] train-rmse:0.561445  
## [608] train-rmse:0.561399  
## [609] train-rmse:0.561362  
## [610] train-rmse:0.561260  
## [611] train-rmse:0.561170 ## [612]  
train-rmse:0.561084 ## [613] train  
rmse:0.561050  
## [614] train rmse:0.561009  
## [615] train rmse:0.560896

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## [616] train rmse:0.560808  
## [617] train rmse:0.560802  
## [618] train rmse:0.560758  
## [619] train rmse:0.560704  
## [620] train rmse:0.560695  
## [621] train rmse:0.560661  
## [622] train rmse:0.560614  
## [623] train rmse:0.560526  
## [624] train-rmse:0.560416  
## [625] train-rmse:0.560366  
## [626] train-rmse:0.560359  
## [627] train-rmse:0.560258  
## [628] train-rmse:0.560213  
## [629] train-rmse:0.560183  
## [630] train-rmse:0.560118  
## [631] train-rmse:0.560045  
## [632] train-rmse:0.560045  
## [633] train-rmse:0.560005  
## [634] train-rmse:0.559984  
## [635] train-rmse:0.559852  
## [636] train-rmse:0.559780  
## [637] train-rmse:0.559732  
## [638] train-rmse:0.559652  
## [639] train-rmse:0.559571  
## [640] train-rmse:0.559488  
## [641] train-rmse:0.559424  
## [642] train-rmse:0.559350

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## [643] train-rmse:0.559271  
## [644] train-rmse:0.559177  
## [645] train-rmse:0.559133  
## [646] train-rmse:0.559046  
## [647] train-rmse:0.558994  
## [648] train-rmse:0.558894  
## [649] train-rmse:0.558822  
## [650] train-rmse:0.558729  
## [651] train-rmse:0.558702  
## [652] train-rmse:0.558696  
## [653] train-rmse:0.558690  
## [654] train-rmse:0.558603  
## [655] train-rmse:0.558501  
## [656] train-rmse:0.558426  
## [657] train-rmse:0.558357  
## [658] train-rmse:0.558322  
## [659] train-rmse:0.558279  
## [660] train-rmse:0.558240  
## [661] train-rmse:0.558210  
## [662] train-rmse:0.558096  
## [663] train rmse:0.558074  
## [664] train rmse:0.557961  
## [665] train rmse:0.557920 ## [666]  
train rmse:0.557846  
## [667] train rmse:0.557839  
## [668] train rmse:0.557823  
## [669] train rmse:0.557763  
## [670] train rmse:0.557678  
## [671] train rmse:0.557651  
## [672] train rmse:0.557560  
## [673] train rmse:0.557560  
## [674] train-rmse:0.557556  
## [675] train-rmse:0.557420  
## [676] train-rmse:0.557382

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## [677] train-rmse:0.557361  
## [678] train-rmse:0.557331  
## [679] train-rmse:0.557165  
## [680] train-rmse:0.557043  
## [681] train-rmse:0.557010  
## [682] train-rmse:0.556883  
## [683] train-rmse:0.556822  
## [684] train-rmse:0.556749  
## [685] train-rmse:0.556685  
## [686] train-rmse:0.556656  
## [687] train-rmse:0.556534  
## [688] train-rmse:0.556433  
## [689] train-rmse:0.556387  
## [690] train-rmse:0.556345  
## [691] train-rmse:0.556276  
## [692] train-rmse:0.556196  
## [693] train-rmse:0.556129  
## [694] train-rmse:0.556098  
## [695] train-rmse:0.556087  
## [696] train-rmse:0.556022  
## [697] train-rmse:0.555907  
## [698] train-rmse:0.555800  
## [699] train-rmse:0.555728  
## [700] train-rmse:0.555708  
## [701] train-rmse:0.555664  
## [702] train-rmse:0.555613  
## [703] train-rmse:0.555506  
## [704] train-rmse:0.555434  
## [705] train-rmse:0.555411  
## [706] train-rmse:0.555359  
## [707] train-rmse:0.555323  
## [708] train-rmse:0.555262  
## [709] train-rmse:0.555186  
## [710] train-rmse:0.555164



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## [711] train-rmse:0.555138  
## [712] train-rmse:0.555086 ## [713]  
train-rmse:0.555059 ## [714] train  
rmse:0.555029  
## [715] train rmse:0.554960 ## [716]  
train rmse:0.554933  
## [717] train rmse:0.554918  
## [718] train rmse:0.554870  
## [719] train rmse:0.554847  
## [720] train rmse:0.554830  
## [721] train-rmse:0.554803  
## [722] train-rmse:0.554764  
## [723] train-rmse:0.554724  
## [724] train-rmse:0.554703  
## [725] train-rmse:0.554668  
## [726] train-rmse:0.554668  
## [727] train-rmse:0.554567  
## [728] train-rmse:0.554499  
## [729] train-rmse:0.554499  
## [730] train-rmse:0.554475  
## [731] train-rmse:0.554445  
## [732] train-rmse:0.554418  
## [733] train-rmse:0.554371  
## [734] train-rmse:0.554298  
## [735] train-rmse:0.554248  
## [736] train-rmse:0.554165  
## [737] train-rmse:0.554048  
## [738] train-rmse:0.553964  
## [739] train-rmse:0.553785  
## [740] train-rmse:0.553774  
## [741] train-rmse:0.553748  
## [742] train-rmse:0.553698  
## [743] train-rmse:0.553636  
## [744] train-rmse:0.553566  
## [745] train-rmse:0.553554

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```
## [746] train-rmse:0.553521  
## [747] train-rmse:0.553512  
## [748] train-rmse:0.553420  
## [749] train-rmse:0.553361 ## [750]  
train-rmse:0.553349
```

```
pred_xgb = predict(mdl_xgb, test_xgb) mse(pred_xgb, test_y)
```

```
## [1] 0.3820247
```

```
### Stacked Generalization ###  
library(data.table) library(foreach)  
library(MatrixModels)
```

```
library(e1071) library(FNN)  
library(glmnet) library(ranger)
```

```

library(xgboost)

# load and combine
dataset train = "BlogFeedback-Train.csv") "BlogFeedback-Test.csv")
fread( test = fread(

  # error measure y_hat, y) {
  mse = function( - y_hat)^2)
  mse = mean((y
  return(mse)
}

# create design
matrices test_x = (V281 ~ . - 1, data = test, sparse = F)
model.Matrix(V281 ~ . - 1, data = test, sparse = T) #test_xgb = xgb.DMatrix(data =
as.matrix(test_x), label = test_y)
test_x_sparse =

V281
V281
train_y = train$
test_y = test$

# divide training set into k folds

k = 5 cv_index = 1:
nrow cv_index_split
=
# meta
features from kNN # split the raining set into two disjoint sets setdiff(1:nrow(train),
cv_index_split[[i]])
meta_knn_test = model.Matrix(V281 ~ . - 1, data = train[train_index], sparse = model.Matrix(V281
meta_knn_train = ~ . - 1, data = train[cv_index_split[[i]]],
train_index =
train_set1 = T)
train_set2 = sparse
= T)

# level 0 prediction knn.reg(train_set1, train_set2, train[train_index]$V281, k = 19
meta_pred =
)$pred
meta_knn_test = meta_knn_test + knn.reg( train_set1, test_x_sparse, train[tr k = 19)$pred / k
ain_index]$ V281,
)
return(
meta_pred
}

rep(0, nrow(test))
# meta features foreach(i = 1:k, .combine = c) %do% {
from LASSO # split the raining set into two disjoint sets

```

```
meta_glm_test =  
meta_glm_train =
```

```
train_index = setdiff(1:nrow(train), cv_index_split[[i]])
```

```

train_set1 = model.Matrix(V281 ~ . - 1, data = train[train_index], T)
train_set2 = model.Matrix(V281 ~ . - 1, data = sparse =
train[cv_index_split[[i]]],

# level 0 prediction
temp_glm = cv.glmnet(train_set1, train[train_index]$ V281, n", alpha = 1)
meta_pred = predict(temp_glm, newx = train_set2) meta_glm_test =
meta_glm_test + predict(temp_glm, newx =
return(meta_pred)
}

# meta features from SVM meta_svm_test = rep(0, nrow(test))
meta_svm_train = foreach(i = 1:k, .combine = c) %do% { # split the raining
set into two disjoint sets train_index = setdiff(1:nrow(train),
cv_index_split[[i]]) train_set1 = train[train_index] train_set2 =
train[cv_index_split[[i]]]

# level 0 prediction
temp_svm = svm(V281 ~ V52 + V55 + V61 + V51 + V54 + V21 + train_set1,
kernel = "radial", cost = 2, gamma = 0.25) meta_pred =
predict(temp_svm, train_set2)
meta_svm_test = meta_svm_test + predict(temp_svm, test) /
return(meta_pred)
}

# meta features from random forest meta_rf_test = rep(0, nrow(test))
meta_rf_train = foreach(i = 1:k, .combine = c) %do% { # split the raining set
into two disjoint sets train_index = setdiff(1:nrow(train), cv_index_split[[i]])
train_set1 = train[train_index] train_set2 = train[cv_index_split[[i]]]

# level 0 prediction
temp_rf = ranger(V281 ~ ., data = train_set1, num.trees = write.forest = T)
meta_pred = predict(temp_rf, train_set2)$predictions meta_rf_test =
meta_rf_test + predict(temp_rf, test)$

500, mtry = 120,

return(meta_pred)

```

```

}

## Growin
nds. onds.          g trees.. Progress: 7%. Estimated remaining time: 7 minutes, 18 seco

nds.          ## Growing trees.. Progress: 14%. Estimated remaining time: 6 minutes, 33
sec
## Growing trees.
onds. onds.          ## Growing trees.. Progress: 21%. Estimated remaining time: 5 minutes, 57
sec

onds.          . Progress: 28%. Estimated remaining time: 5 minutes,
## Growing trees.. Progr
onds. onds.          25 sec ## Growing trees.. Progress: 35%. Estimated remaining time: 4
minutes, 51 sec

onds.
## Growing trees..
Progress: 71 nds. nds. ## Growing trees.. Progress: 43%. Estimated remaining time: 4 minutes, 18
ds.          sec

          ess: 50%. Estimated remaining time: 3 minutes, 45 sec

nds. onds.          ## Growing trees.. Progress: 57%. Estimated remaining time: 3 minutes, 13
onds. onds.          sec
onds. onds.          ## Growing trees.. Progress: 64%. Estimated remaining time: 2 minutes, 40
onds. onds.          sec
onds. onds.
nds.          %. Estimated remaining time: 2
minutes, 8 seco ## Growing trees.. Progress: 79%. Estimated remaining time:
1 minute, 36 seco

## Growing trees.. Progress: 86%. Estimated remaining time: 1 minute, 3
secon

## Growing trees.. Progress: 93%. Estimated remaining time: 31 seconds.
## Growing trees.. Progress: 7%. Estimated remaining time: 7 minutes, 18
seco

## Growing trees.. Progress: 14%. Estimated remaining time: 6 minutes, 33
sec

```

## Growing trees.. Progress: 21%. Estimated remaining time: 5 minutes, 57 sec

## Growing trees.. Progress: 28%. Estimated remaining time: 5 minutes, 26 sec

## Growing trees.. Progress: 35%. Estimated remaining time: 4 minutes, 56 sec

## Growing trees.. Progress: 41%. Estimated remaining time: 4 minutes, 31 sec

## Growing trees.. Progress: 48%. Estimated remaining time: 3 minutes, 58 sec

## Growing trees.. Progress: 55%. Estimated remaining time: 3 minutes, 24 sec

## Growing trees.. Progress: 62%. Estimated remaining time: 2 minutes, 51 sec

## Growing trees.. Progress: 70%. Estimated remaining time: 2 minutes, 18 sec

## Growing trees.. Progress: 77%. Estimated remaining time: 1 minute, 46 seco

## Growing trees.. Progress: 84%. Estimated remaining time: 1 minute, 13 seco nds.

## Growing trees.. Progress: 91%. Estimated remaining time: 40 seconds. ## Growing trees..  
Progress: 98%. Estimated remaining time: 8 seconds.  
## Growing trees.. Progress: 7%. Estimated remaining time: 6 minutes, 51 seconds.  
## Growing trees.. Progress: 14%. Estimated remaining time: 6 minutes, 20 seconds.  
## Growing trees.. Progress: 21%. Estimated remaining time: 5 minutes, 45 seconds.  
## Growing trees.. Progress: 29%. Estimated remaining time: 5 minutes, 9 seconds.  
## Growing trees.. Progress: 36%. Estimated remaining time: 4 minutes, 39 seconds.  
## Growing trees.. Progress: 43%. Estimated remaining time: 4 minutes, 8 seconds.  
## Growing trees.. Progress: 51%. Estimated remaining time: 3 minutes, 34 seconds.  
## Growing trees.. Progress: 58%. Estimated remaining time: 3 minutes, 3 seconds.  
## Growing trees.. Progress: 65%. Estimated remaining time: 2 minutes, 33 seconds.  
## Growing trees.. Progress: 71%. Estimated remaining time: 2 minutes, 5 seconds.  
## Growing trees.. Progress: 78%. Estimated remaining time: 1 minute, 35 seconds.  
## Growing trees.. Progress: 86%. Estimated remaining time: 1 minute, 2 seconds.  
## Growing trees.. Progress: 93%. Estimated remaining time: 31 seconds.  
## Growing trees.. Progress: 100%. Estimated remaining time: 0 seconds.  
## Growing trees.. Progress: 7%. Estimated remaining time: 7 minutes, 32 seconds.  
## Growing trees.. Progress: 14%. Estimated remaining time: 6 minutes, 46 seconds.  
## Growing trees.. Progress: 21%. Estimated remaining time: 6 minutes, 4 seconds.  
## Growing trees.. Progress: 28%. Estimated remaining time: 5 minutes, 33 seconds.  
## Growing trees.. Progress: 35%. Estimated remaining time: 4 minutes, 57 seconds.  
## Growing trees.. Progress: 43%. Estimated remaining time: 4 minutes, 22 seconds.  
## Growing trees.. Progress: 50%. Estimated remaining time: 3 minutes, 51 seconds.  
## Growing trees.. Progress: 57%. Estimated remaining time: 3 minutes, 18 seconds.  
## Growing trees.. Progress: 63%. Estimated remaining time: 2 minutes, 47 seconds.  
## Growing trees.. Progress: 70 %. Estimated remaining time: 2 minutes, 15 seconds.



```

## Growing trees.. Progress: 77%. Estimated remaining time: 1 minute, 44 seconds.
## Growing trees.. Progress: 84%. Estimated remaining time: 1 minute, 14 seconds.
## Growing trees.. Progress: 91%. Estimated remaining time: 43 seconds.
## Growing trees.. Progress: 98%. Estimated remaining time: 11 seconds.
## Growing trees.. Progress: 7%. Estimated remaining time: 7 minutes, 32 seconds.
## Growing trees.. Progress: 14%. Estimated remaining time: 6 minutes, 46 seconds.
## Growing trees.. Progress: 20%. Estimated remaining time: 6 minutes, 19 seconds.
## Growing trees.. Progress: 27%. Estimated remaining time: 5 minutes, 39 seconds.
## Growing trees.. Progress: 34%. Estimated remaining time: 5 minutes, 7 seconds.
## Growing trees.. Progress: 41%. Estimated remaining time: 4 minutes, 36 seconds.
## Growing trees.. Progress: 48%. Estimated remaining time: 4 minutes, 1 seconds.
## Growing trees.. Progress: 55%. Estimated remaining time: 3 minutes, 28 seconds.
## Growing trees.. Progress: 62%. Estimated remaining time: 2 minutes, 54 seconds.
## Growing trees.. Progress: 69%. Estimated remaining time: 2 minutes, 23 seconds.
## Growing trees.. Progress: 76%. Estimated remaining time: 1 minute, 52 seconds.
## Growing trees.. Progress: 83%. Estimated remaining time: 1 minute, 18 seconds.
## Growing trees.. Progress: 90%. Estimated remaining time: 46 seconds.
## Growing trees.. Progress: 97%. Estimated remaining time: 14 seconds.

```

```

# meta features from XGBoost meta_xgb_test = rep(0,
nrow(test))
meta_xgb_train = foreach(i = 1:k, .combine = c) %do% { # split the training set
into two disjoint sets train_index = setdiff(1:nrow(train), cv_index_split[[i]])
train_set1 = model.matrix(V281 ~ . - 1, data = train[train_index], sparse = F)
train_set2 = model.matrix(V281 ~ . - 1, data = train[cv_index_split[[i]]], sparse = F)

# xgb data
train_set1_xgb = xgb.DMatrix(data = as.matrix(train_set1), label = train[train_index]$V281)
train_set2_xgb = xgb.DMatrix(data = as.matrix(train_set2), label = train[cv_index_split[[i]]]$V281)

# level 0 prediction
temp_xgb = xgboost(data = train_set1_xgb, nround = 750, nthread = 4, max_depth

```

```
pth = 6, eta = 0.025, subsample = 0.7, gamma = 3) meta_pred =  
predict(temp_xgb, train_set2_xgb)  
meta_xgb_test = meta_xgb_test + predict(temp_xgb, test_xgb) / k  
return(meta_pred)  
}
```

```
## [1] train-rmse:1.041304  
## [2] train-rmse:1.025138  
## [3] train-rmse:1.009468  
## [4] train-rmse:0.994396  
## [5] train-rmse:0.979805  
## [6] train-rmse:0.965819  
## [7] train-rmse:0.952242  
## [8] train-rmse:0.938961  
## [9] train-rmse:0.926142  
## [10] train-rmse:0.913679  
## [11] train-rmse:0.901632  
## [12] train-rmse:0.890118  
## [13] train-rmse:0.879104  
## [14] train-rmse:0.868265  
## [15] train-rmse:0.857938  
## [16] train-rmse:0.847930  
## [17] train-rmse:0.838117  
## [18] train-rmse:0.828828  
## [19] train-rmse:0.819844  
## [20] train-rmse:0.811192  
## [21] train-rmse:0.802804  
## [22] train-rmse:0.794738  
## [23] train-rmse:0.786939  
## [24] train-rmse:0.779281  
## [25] train-rmse:0.772032  
## [26] train-rmse:0.765034  
## [27] train-rmse:0.758150  
## [28] train-rmse:0.751556  
## [29] train-rmse:0.745162  
## [30] train-rmse:0.738988  
## [31] train-rmse:0.733033  
## [32] train-rmse:0.727371  
## [33] train-rmse:0.721907  
## [34] train-rmse:0.716632  
## [35] train-rmse:0.711528  
## [36] train-rmse:0.706603  
## [37] train-rmse:0.701833  
## [38] train-rmse:0.697339
```

```
## [39] train-rmse:0.692959
## [40] train-rmse:0.688686
## [41] train-rmse:0.684591
## [42] train-rmse:0.680710
```

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## [43] train-rmse:0.676987
```

## [44] train-rmse:0.673420  
## [45] train-rmse:0.669937  
## [46] train-rmse:0.666470  
## [47] train-rmse:0.663170  
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## [52] train-rmse:0.648544  
## [53] train-rmse:0.645853  
## [54] train-rmse:0.643262  
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## [67] train-rmse:0.617301  
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## [82] train-rmse:0.598504  
## [83] train-rmse:0.597522  
## [84] train-rmse:0.596601  
## [85] train-rmse:0.595565

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```

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## [124] train-rmse:0.571827
## [125] train-rmse:0.571466
## [126] train-rmse:0.571032
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## [147] train-rmse:0.563932  
## [148] train-rmse:0.563577 ## [149]  
train-rmse:0.563256 ## [150] train-  
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## [153] train-rmse:0.562205  
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## [237] train-rmse:0.546053  
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train-rmse:0.545295 ## [243] train  
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## [261] train-rmse:0.542866  
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## [291] train rmse:0.539175  
## [292] train rmse:0.539105

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## [293] train rmse:0.539012  
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## [319] train-rmse:0.536401

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## [320] train-rmse:0.536269  
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## [325] train-rmse:0.535809  
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## [334] train-rmse:0.534862  
## [335] train-rmse:0.534779 ## [336]  
train-rmse:0.534729  
## [337] train-rmse:0.534579  
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## [340] train rmse:0.534304  
## [341] train rmse:0.534275  
## [342] train rmse:0.534205 ## [343]  
train-rmse:0.534108 ## [344] train-  
rmse:0.533977  
## [345] train-rmse:0.533888  
## [346] train-rmse:0.533726

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## [347] train-rmse:0.533637  
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## [349] train-rmse:0.533356  
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## [351] train-rmse:0.533232  
## [352] train-rmse:0.533087  
## [353] train-rmse:0.532931  
## [354] train-rmse:0.532860  
## [355] train-rmse:0.532825  
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## [357] train-rmse:0.532637  
## [358] train-rmse:0.532562  
## [359] train-rmse:0.532501  
## [360] train-rmse:0.532393  
## [361] train-rmse:0.532259  
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## [363] train-rmse:0.532029  
## [364] train-rmse:0.531969  
## [365] train-rmse:0.531899  
## [366] train-rmse:0.531771  
## [367] train-rmse:0.531737  
## [368] train-rmse:0.531640  
## [369] train-rmse:0.531543  
## [370] train-rmse:0.531421  
## [371] train-rmse:0.531401  
## [372] train-rmse:0.531305  
## [373] train-rmse:0.531256

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## [374] train-rmse:0.531139  
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## [377] train-rmse:0.530827  
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## [379] train-rmse:0.530714  
## [380] train-rmse:0.530560  
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## [382] train-rmse:0.530281  
## [383] train-rmse:0.530255  
## [384] train-rmse:0.530220  
## [385] train-rmse:0.530057  
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## [387] train-rmse:0.529904  
## [388] train-rmse:0.529832  
## [389] train-rmse:0.529662  
## [390] train-rmse:0.529565  
## [391] train rmse:0.529415  
## [392] train rmse:0.529348 ## [393]  
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## [394] train rmse:0.529125  
## [395] train rmse:0.529058  
## [396] train rmse:0.529045  
## [397] train rmse:0.528920  
## [398] train-rmse:0.528892  
## [399] train-rmse:0.528801  
## [400] train-rmse:0.528714

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## [401] train-rmse:0.528664  
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## [413] train-rmse:0.527872  
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## [419] train-rmse:0.527297  
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## [421] train-rmse:0.527083  
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## [425] train-rmse:0.526877  
## [426] train-rmse:0.526735  
## [427] train-rmse:0.526630

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## [428] train-rmse:0.526603  
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## [430] train-rmse:0.526427  
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## [432] train-rmse:0.526265  
## [433] train-rmse:0.526157  
## [434] train-rmse:0.526103  
## [435] train-rmse:0.526045 ## [436]  
train-rmse:0.525971 ## [437] train-  
rmse:0.525805  
## [438] train rmse:0.525745  
## [439] train rmse:0.525713  
## [440] train rmse:0.525679  
## [441] train rmse:0.525602  
## [442] train rmse:0.525544

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## [443] train rmse:0.525538  
## [444] train rmse:0.525366  
## [445] train-rmse:0.525323  
## [446] train rmse:0.525207  
## [447] train rmse:0.525075  
## [448] train-rmse:0.524969  
## [449] train-rmse:0.524840  
## [450] train-rmse:0.524700  
## [451] train-rmse:0.524546  
## [452] train-rmse:0.524527  
## [453] train-rmse:0.524466  
## [454] train-rmse:0.524395  
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## [457] train-rmse:0.524219  
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## [459] train-rmse:0.524032  
## [460] train-rmse:0.523972  
## [461] train-rmse:0.523788  
## [462] train-rmse:0.523741  
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## [464] train-rmse:0.523515  
## [465] train-rmse:0.523477  
## [466] train-rmse:0.523384  
## [467] train-rmse:0.523384  
## [468] train-rmse:0.523275  
## [469] train-rmse:0.523177

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## [470] train-rmse:0.523073  
## [471] train-rmse:0.523048  
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## [474] train-rmse:0.522737  
## [475] train-rmse:0.522672  
## [476] train-rmse:0.522620  
## [477] train-rmse:0.522606  
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## [480] train-rmse:0.522376  
## [481] train-rmse:0.522242  
## [482] train-rmse:0.522212  
## [483] train-rmse:0.522166  
## [484] train-rmse:0.522080  
## [485] train-rmse:0.521946  
## [486] train-rmse:0.521882  
## [487] train-rmse:0.521882  
## [488] train rmse:0.521756  
## [489] train rmse:0.521684  
## [490] train rmse:0.521632  
## [491] train rmse:0.521562  
## [492] train rmse:0.521542 ## [493]  
train rmse:0.521492  
## [494] train rmse:0.521456  
## [495] train rmse:0.521371  
## [496] train rmse:0.521219

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## [497] train rmse:0.521085 ## [498]  
train-rmse:0.521021 ## [499] train-  
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## [500] train-rmse:0.520772  
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## [502] train-rmse:0.520642  
## [503] train-rmse:0.520623  
## [504] train-rmse:0.520483  
## [505] train-rmse:0.520362  
## [506] train-rmse:0.520312  
## [507] train-rmse:0.520220  
## [508] train-rmse:0.520161  
## [509] train-rmse:0.520091  
## [510] train-rmse:0.520018  
## [511] train-rmse:0.519946  
## [512] train-rmse:0.519911  
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## [514] train-rmse:0.519650  
## [515] train-rmse:0.519525  
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## [517] train-rmse:0.519401  
## [518] train-rmse:0.519322  
## [519] train-rmse:0.519210  
## [520] train-rmse:0.519134  
## [521] train-rmse:0.519042  
## [522] train-rmse:0.519023  
## [523] train-rmse:0.518987

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## [524] train-rmse:0.518961  
## [525] train-rmse:0.518899  
## [526] train-rmse:0.518874  
## [527] train-rmse:0.518793  
## [528] train-rmse:0.518700  
## [529] train-rmse:0.518542  
## [530] train-rmse:0.518507  
## [531] train-rmse:0.518498  
## [532] train-rmse:0.518377  
## [533] train-rmse:0.518353  
## [534] train-rmse:0.518274  
## [535] train-rmse:0.518217  
## [536] train-rmse:0.518193 ## [537]  
train-rmse:0.518095 ## [538] train  
rmse:0.518062  
## [539] train rmse:0.517943  
## [540] train rmse:0.517914  
## [541] train rmse:0.517869  
## [542] train rmse:0.517835 ## [543]  
train rmse:0.517786  
## [544] train rmse:0.517702  
## [545] train-rmse:0.517572  
## [546] train-rmse:0.517520  
## [547] train-rmse:0.517446  
## [548] train-rmse:0.517410  
## [549] train-rmse:0.517338  
## [550] train-rmse:0.517228

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## [551] train-rmse:0.517167  
## [552] train-rmse:0.517134  
## [553] train-rmse:0.517093  
## [554] train-rmse:0.516976  
## [555] train-rmse:0.516958  
## [556] train-rmse:0.516905  
## [557] train-rmse:0.516895  
## [558] train-rmse:0.516835  
## [559] train-rmse:0.516794  
## [560] train-rmse:0.516785  
## [561] train-rmse:0.516743  
## [562] train-rmse:0.516733  
## [563] train-rmse:0.516618  
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## [565] train-rmse:0.516546  
## [566] train-rmse:0.516471  
## [567] train-rmse:0.516443  
## [568] train-rmse:0.516326  
## [569] train-rmse:0.516241  
## [570] train-rmse:0.516157  
## [571] train-rmse:0.516139  
## [572] train-rmse:0.516059  
## [573] train-rmse:0.516010  
## [574] train-rmse:0.515970  
## [575] train-rmse:0.515895  
## [576] train-rmse:0.515834  
## [577] train-rmse:0.515825

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## [578] train-rmse:0.515799  
## [579] train-rmse:0.515701  
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## [581] train-rmse:0.515568  
## [582] train-rmse:0.515568  
## [583] train-rmse:0.515436  
## [584] train-rmse:0.515373  
## [585] train-rmse:0.515331  
## [586] train-rmse:0.515327  
## [587] train-rmse:0.515218  
## [588] train-rmse:0.515218  
## [589] train-rmse:0.515176  
## [590] train-rmse:0.515078 ## [591]  
train-rmse:0.515046 ## [592] train  
rmse:0.514971

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## [593] train rmse:0.514860  
## [594] train rmse:0.514784  
## [595] train rmse:0.514743  
## [596] train rmse:0.514696  
## [597] train rmse:0.514635  
## [598] train-rmse:0.514617 ## [599]  
train-rmse:0.514499 ## [600] train-  
rmse:0.514453  
## [601] train-rmse:0.514417  
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## [603] train-rmse:0.514194  
## [604] train-rmse:0.514179  
## [605] train-rmse:0.514074  
## [606] train-rmse:0.514009  
## [607] train-rmse:0.513919  
## [608] train-rmse:0.513816  
## [609] train-rmse:0.513780  
## [610] train-rmse:0.513780  
## [611] train-rmse:0.513703  
## [612] train-rmse:0.513658  
## [613] train-rmse:0.513564  
## [614] train-rmse:0.513517  
## [615] train-rmse:0.513476  
## [616] train-rmse:0.513404  
## [617] train-rmse:0.513222  
## [618] train-rmse:0.513183  
## [619] train-rmse:0.513102

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## [620] train-rmse:0.512933  
## [621] train-rmse:0.512933  
## [622] train-rmse:0.512848  
## [623] train-rmse:0.512837  
## [624] train-rmse:0.512802  
## [625] train-rmse:0.512709  
## [626] train-rmse:0.512696  
## [627] train-rmse:0.512672  
## [628] train-rmse:0.512658  
## [629] train-rmse:0.512510  
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## [631] train-rmse:0.512364  
## [632] train-rmse:0.512345  
## [633] train-rmse:0.512316  
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## [635] train-rmse:0.512251  
## [636] train-rmse:0.512178  
## [637] train-rmse:0.512131  
## [638] train-rmse:0.512071  
## [639] train rmse:0.511981  
## [640] train rmse:0.511927  
## [641] train-rmse:0.511892  
## [642] train rmse:0.511886 ## [643]  
train rmse:0.511861  
## [644] train rmse:0.511850  
## [645] train rmse:0.511715  
## [646] train-rmse:0.511659  
## [647] train-rmse:0.511559

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## [648] train-rmse:0.511507  
## [649] train-rmse:0.511484  
## [650] train-rmse:0.511469  
## [651] train-rmse:0.511443  
## [652] train-rmse:0.511398  
## [653] train-rmse:0.511364  
## [654] train-rmse:0.511206  
## [655] train-rmse:0.511145  
## [656] train-rmse:0.511134  
## [657] train-rmse:0.510977  
## [658] train-rmse:0.510924  
## [659] train-rmse:0.510831  
## [660] train-rmse:0.510734  
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## [662] train-rmse:0.510594  
## [663] train-rmse:0.510564  
## [664] train-rmse:0.510535  
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## [666] train-rmse:0.510472  
## [667] train-rmse:0.510439  
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## [669] train-rmse:0.510347  
## [670] train-rmse:0.510285  
## [671] train-rmse:0.510209  
## [672] train-rmse:0.510100  
## [673] train-rmse:0.510012  
## [674] train-rmse:0.509960  
## [675] train-rmse:0.509853

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## [676] train-rmse:0.509787  
## [677] train-rmse:0.509784  
## [678] train-rmse:0.509725  
## [679] train-rmse:0.509626  
## [680] train-rmse:0.509525  
## [681] train-rmse:0.509511  
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## [683] train-rmse:0.509462  
## [684] train-rmse:0.509397  
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## [686] train-rmse:0.509287  
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## [688] train-rmse:0.509240  
## [689] train-rmse:0.509241  
## [690] train-rmse:0.509241  
## [691] train-rmse:0.509233 ## [692]  
train-rmse:0.509101 ## [693] train  
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## [695] train rmse:0.508927  
## [696] train-rmse:0.508863  
## [697] train-rmse:0.508793  
## [698] train-rmse:0.508683  
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## [700] train-rmse:0.508580  
## [701] train-rmse:0.508503  
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## [703] train-rmse:0.508455

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## [704] train-rmse:0.508417  
## [705] train-rmse:0.508367  
## [706] train-rmse:0.508236  
## [707] train-rmse:0.508236  
## [708] train-rmse:0.508152  
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## [710] train-rmse:0.508111  
## [711] train-rmse:0.508102  
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## [713] train-rmse:0.508076  
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## [716] train-rmse:0.507953  
## [717] train-rmse:0.507909  
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## [722] train-rmse:0.507676  
## [723] train-rmse:0.507573  
## [724] train-rmse:0.507507  
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## [726] train-rmse:0.507400  
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## [728] train-rmse:0.507354  
## [729] train-rmse:0.507345  
## [730] train-rmse:0.507282  
## [731] train-rmse:0.507270

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## [732] train-rmse:0.507222
## [733] train-rmse:0.507192
## [734] train-rmse:0.507161
## [735] train-rmse:0.507111
## [736] train-rmse:0.507017
## [737] train-rmse:0.506940
## [738] train-rmse:0.506906
## [739] train-rmse:0.506854
## [740] train-rmse:0.506829
## [741] train-rmse:0.506806
## [742] train-rmse:0.506789 ## [743]
train rmse:0.506742
## [744] train rmse:0.506670
## [745] train rmse:0.506581
## [746] train-rmse:0.506581
## [747] train-rmse:0.506509
## [748] train-rmse:0.506468
## [749] train-rmse:0.506461
## [750] train-rmse:0.506437
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## [2] train-rmse:1.003946
## [3] train-rmse:0.989538
## [4] train-rmse:0.975828
## [5] train-rmse:0.962640
## [6] train-rmse:0.949864
## [7] train-rmse:0.937224
## [8] train-rmse:0.925069
## [9] train-rmse:0.913437
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## [10] train-rmse:0.902096  
## [11] train-rmse:0.891230  
## [12] train-rmse:0.880851  
## [13] train-rmse:0.870718  
## [14] train-rmse:0.861060  
## [15] train-rmse:0.851711  
## [16] train-rmse:0.842587  
## [17] train-rmse:0.833747  
## [18] train-rmse:0.825244  
## [19] train-rmse:0.816911  
## [20] train-rmse:0.809049  
## [21] train-rmse:0.801463  
## [22] train-rmse:0.794179  
## [23] train-rmse:0.787223  
## [24] train-rmse:0.780367  
## [25] train-rmse:0.773792  
## [26] train-rmse:0.767575  
## [27] train-rmse:0.761424  
## [28] train-rmse:0.755614  
## [29] train-rmse:0.749969  
## [30] train-rmse:0.744510  
## [31] train-rmse:0.739273  
## [32] train-rmse:0.734099  
## [33] train-rmse:0.729237  
## [34] train-rmse:0.724521  
## [35] train-rmse:0.719953  
## [36] train-rmse:0.715568  
## [37] train-rmse:0.711449

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## [38] train-rmse:0.707342  
## [39] train-rmse:0.703360  
## [40] train-rmse:0.699657  
## [41] train-rmse:0.696041  
## [42] train-rmse:0.692522



## [43] train-rmse:0.689138  
## [44] train-rmse:0.685843  
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## [46] train-rmse:0.679671  
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## [49] train-rmse:0.671009  
## [50] train-rmse:0.668377  
## [51] train-rmse:0.665830  
## [52] train-rmse:0.663392  
## [53] train-rmse:0.661117  
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## [55] train-rmse:0.656539  
## [56] train-rmse:0.654498  
## [57] train-rmse:0.652459  
## [58] train-rmse:0.650478  
## [59] train-rmse:0.648540  
## [60] train-rmse:0.646707  
## [61] train-rmse:0.644943  
## [62] train-rmse:0.643228  
## [63] train-rmse:0.641595  
## [64] train-rmse:0.639874  
## [65] train-rmse:0.638177  
## [66] train-rmse:0.636597  
## [67] train-rmse:0.635101  
## [68] train-rmse:0.633624  
## [69] train-rmse:0.632208

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## [70] train-rmse:0.630866  
## [71] train-rmse:0.629644  
## [72] train-rmse:0.628351  
## [73] train-rmse:0.627195  
## [74] train-rmse:0.626002  
## [75] train-rmse:0.624815  
## [76] train-rmse:0.623668  
## [77] train-rmse:0.622592  
## [78] train-rmse:0.621544  
## [79] train-rmse:0.620460  
## [80] train-rmse:0.619357  
## [81] train-rmse:0.618384  
## [82] train-rmse:0.617393  
## [83] train-rmse:0.616434  
## [84] train-rmse:0.615495  
## [85] train-rmse:0.614525  
## [86] train-rmse:0.613729  
## [87] train-rmse:0.612842  
## [88] train-rmse:0.612062  
## [89] train-rmse:0.611348  
## [90] train-rmse:0.610628  
## [91] train-rmse:0.609886  
## [92] train-rmse:0.609079 ## [93] train-  
rmse:0.608458  
## [94] train-rmse:0.607685  
## [95] train-rmse:0.606970  
## [96] train-rmse:0.606259

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## [97] train-rmse:0.605593  
## [98] train-rmse:0.604868  
## [99] train-rmse:0.604231  
## [100] train-rmse:0.603608  
## [101] train-rmse:0.603016  
## [102] train-rmse:0.602459  
## [103] train-rmse:0.601834  
## [104] train-rmse:0.601331  
## [105] train-rmse:0.600724  
## [106] train-rmse:0.600227  
## [107] train-rmse:0.599653  
## [108] train-rmse:0.599180  
## [109] train-rmse:0.598596  
## [110] train-rmse:0.598089  
## [111] train-rmse:0.597647  
## [112] train-rmse:0.597165  
## [113] train-rmse:0.596768  
## [114] train-rmse:0.596346  
## [115] train-rmse:0.595890  
## [116] train-rmse:0.595419  
## [117] train-rmse:0.594939  
## [118] train-rmse:0.594470  
## [119] train-rmse:0.593984  
## [120] train-rmse:0.593589  
## [121] train-rmse:0.593064  
## [122] train-rmse:0.592723  
## [123] train-rmse:0.592389

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## [124] train-rmse:0.592037  
## [125] train-rmse:0.591612  
## [126] train-rmse:0.591232  
## [127] train-rmse:0.590827  
## [128] train-rmse:0.590425  
## [129] train-rmse:0.590046  
## [130] train-rmse:0.589733  
## [131] train-rmse:0.589419  
## [132] train-rmse:0.589109  
## [133] train-rmse:0.588786  
## [134] train-rmse:0.588489  
## [135] train-rmse:0.588124  
## [136] train-rmse:0.587761  
## [137] train-rmse:0.587440  
## [138] train-rmse:0.587150  
## [139] train-rmse:0.586807  
## [140] train-rmse:0.586483  
## [141] train-rmse:0.586130  
## [142] train rmse:0.585781 ## [143]  
train rmse:0.585455  
## [144] train rmse:0.585199  
## [145] train rmse:0.584897  
## [146] train rmse:0.584651  
## [147] train rmse:0.584469 ## [148]  
train-rmse:0.584278 ## [149] train-  
rmse:0.583970  
## [150] train-rmse:0.583680

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## [151] train-rmse:0.583485  
## [152] train-rmse:0.583236  
## [153] train-rmse:0.582955  
## [154] train-rmse:0.582686  
## [155] train-rmse:0.582513  
## [156] train-rmse:0.582374  
## [157] train-rmse:0.582040  
## [158] train-rmse:0.581788  
## [159] train-rmse:0.581555  
## [160] train-rmse:0.581292  
## [161] train-rmse:0.581096  
## [162] train-rmse:0.580897  
## [163] train-rmse:0.580705  
## [164] train-rmse:0.580473  
## [165] train-rmse:0.580280  
## [166] train-rmse:0.580118  
## [167] train-rmse:0.579837  
## [168] train-rmse:0.579560  
## [169] train-rmse:0.579334  
## [170] train-rmse:0.579031  
## [171] train-rmse:0.578846  
## [172] train-rmse:0.578687  
## [173] train-rmse:0.578463  
## [174] train-rmse:0.578229  
## [175] train-rmse:0.577969  
## [176] train-rmse:0.577732  
## [177] train-rmse:0.577457

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## [178] train-rmse:0.577226  
## [179] train-rmse:0.577029  
## [180] train-rmse:0.576951  
## [181] train-rmse:0.576673  
## [182] train-rmse:0.576524  
## [183] train-rmse:0.576346  
## [184] train-rmse:0.576229  
## [185] train-rmse:0.576050  
## [186] train-rmse:0.575785  
## [187] train-rmse:0.575472  
## [188] train-rmse:0.575290  
## [189] train rmse:0.575168  
## [190] train rmse:0.574970  
## [191] train rmse:0.574847  
## [192] train rmse:0.574644

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## [193] train rmse:0.574494  
## [194] train rmse:0.574306  
## [195] train-rmse:0.574244  
## [196] train-rmse:0.574062  
## [197] train-rmse:0.573990  
## [198] train-rmse:0.573886  
## [199] train-rmse:0.573774  
## [200] train-rmse:0.573665  
## [201] train-rmse:0.573549  
## [202] train-rmse:0.573351  
## [203] train-rmse:0.573064  
## [204] train-rmse:0.572955  
## [205] train-rmse:0.572809  
## [206] train-rmse:0.572727  
## [207] train-rmse:0.572581  
## [208] train-rmse:0.572483  
## [209] train-rmse:0.572378  
## [210] train-rmse:0.572207  
## [211] train-rmse:0.572160  
## [212] train-rmse:0.571985  
## [213] train-rmse:0.571770  
## [214] train-rmse:0.571524  
## [215] train-rmse:0.571362  
## [216] train-rmse:0.571086  
## [217] train-rmse:0.570876  
## [218] train-rmse:0.570682  
## [219] train-rmse:0.570491

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## [220] train-rmse:0.570281  
## [221] train-rmse:0.570060  
## [222] train-rmse:0.569862  
## [223] train-rmse:0.569759  
## [224] train-rmse:0.569632  
## [225] train-rmse:0.569500  
## [226] train-rmse:0.569395  
## [227] train-rmse:0.569350  
## [228] train-rmse:0.569166  
## [229] train-rmse:0.569067  
## [230] train-rmse:0.568815  
## [231] train-rmse:0.568710  
## [232] train-rmse:0.568602  
## [233] train-rmse:0.568447  
## [234] train-rmse:0.568312  
## [235] train-rmse:0.568210  
## [236] train-rmse:0.567994  
## [237] train-rmse:0.567948  
## [238] train-rmse:0.567780  
## [239] train-rmse:0.567627  
## [240] train-rmse:0.567598 ## [241]  
train-rmse:0.567536 ## [242] train  
rmse:0.567353 ## [243] train  
rmse:0.567202  
## [244] train rmse:0.567101  
## [245] train rmse:0.566890  
## [246] train rmse:0.566745  
## [247] train rmse:0.566633

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## [248] train rmse:0.566519 ## [249]  
train-rmse:0.566400 ## [250] train-  
rmse:0.566311  
## [251] train-rmse:0.566127  
## [252] train-rmse:0.565999  
## [253] train-rmse:0.565859  
## [254] train-rmse:0.565810  
## [255] train-rmse:0.565673  
## [256] train-rmse:0.565496  
## [257] train-rmse:0.565364  
## [258] train-rmse:0.565134  
## [259] train-rmse:0.565070  
## [260] train-rmse:0.564992  
## [261] train-rmse:0.564915  
## [262] train-rmse:0.564865  
## [263] train-rmse:0.564797  
## [264] train-rmse:0.564711  
## [265] train-rmse:0.564629  
## [266] train-rmse:0.564526  
## [267] train-rmse:0.564295  
## [268] train-rmse:0.564234  
## [269] train-rmse:0.564185  
## [270] train-rmse:0.563946  
## [271] train-rmse:0.563881  
## [272] train-rmse:0.563701  
## [273] train-rmse:0.563547  
## [274] train-rmse:0.563374  
## [275] train-rmse:0.563336

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## [276] train-rmse:0.563137  
## [277] train-rmse:0.562940  
## [278] train-rmse:0.562743  
## [279] train-rmse:0.562610  
## [280] train-rmse:0.562502  
## [281] train-rmse:0.562311  
## [282] train-rmse:0.562235  
## [283] train-rmse:0.562205  
## [284] train-rmse:0.562122  
## [285] train-rmse:0.562069  
## [286] train-rmse:0.561931  
## [287] train-rmse:0.561873  
## [288] train-rmse:0.561794  
## [289] train rmse:0.561733  
## [290] train rmse:0.561612  
## [291] train rmse:0.561426  
## [292] train rmse:0.561360 ## [293]  
train rmse:0.561203  
## [294] train rmse:0.561097  
## [295] train rmse:0.561081  
## [296] train rmse:0.561065  
## [297] train rmse:0.561031  
## [298] train rmse:0.560960  
## [299] train rmse:0.560909  
## [300] train-rmse:0.560861  
## [301] train-rmse:0.560850  
## [302] train-rmse:0.560750  
## [303] train-rmse:0.560687

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## [304] train-rmse:0.560646  
## [305] train-rmse:0.560453  
## [306] train-rmse:0.560366  
## [307] train-rmse:0.560307  
## [308] train-rmse:0.560242  
## [309] train-rmse:0.560176  
## [310] train-rmse:0.559960  
## [311] train-rmse:0.559906  
## [312] train-rmse:0.559806  
## [313] train-rmse:0.559742  
## [314] train-rmse:0.559691  
## [315] train-rmse:0.559467  
## [316] train-rmse:0.559405  
## [317] train-rmse:0.559286  
## [318] train-rmse:0.559226  
## [319] train-rmse:0.559176  
## [320] train-rmse:0.559140  
## [321] train-rmse:0.559025  
## [322] train-rmse:0.558960  
## [323] train-rmse:0.558787  
## [324] train-rmse:0.558722  
## [325] train-rmse:0.558701  
## [326] train-rmse:0.558539  
## [327] train-rmse:0.558375  
## [328] train-rmse:0.558329  
## [329] train-rmse:0.558305  
## [330] train-rmse:0.558164  
## [331] train-rmse:0.558041

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## [332] train-rmse:0.557938  
## [333] train-rmse:0.557825  
## [334] train-rmse:0.557621  
## [335] train-rmse:0.557533  
## [336] train-rmse:0.557470  
## [337] train-rmse:0.557401  
## [338] train-rmse:0.557347  
## [339] train-rmse:0.557296  
## [340] train-rmse:0.557058  
## [341] train-rmse:0.556919 ## [342]  
train-rmse:0.556837

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## [343] train rmse:0.556688  
## [344] train rmse:0.556677  
## [345] train rmse:0.556540  
## [346] train rmse:0.556456  
## [347] train rmse:0.556378  
## [348] train rmse:0.556326  
## [349] train rmse:0.556231  
## [350] train-rmse:0.556161  
## [351] train-rmse:0.555980  
## [352] train-rmse:0.555960  
## [353] train-rmse:0.555917  
## [354] train-rmse:0.555908  
## [355] train-rmse:0.555874  
## [356] train-rmse:0.555735  
## [357] train-rmse:0.555696  
## [358] train-rmse:0.555640  
## [359] train-rmse:0.555547  
## [360] train-rmse:0.555522  
## [361] train-rmse:0.555452  
## [362] train-rmse:0.555399  
## [363] train-rmse:0.555337  
## [364] train-rmse:0.555254  
## [365] train-rmse:0.555207  
## [366] train-rmse:0.555045  
## [367] train-rmse:0.554883  
## [368] train-rmse:0.554792  
## [369] train-rmse:0.554690  
## [370] train-rmse:0.554662  
## [371] train-rmse:0.554561

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## [372] train-rmse:0.554397  
## [373] train-rmse:0.554397  
## [374] train-rmse:0.554318  
## [375] train-rmse:0.554254  
## [376] train-rmse:0.554120  
## [377] train-rmse:0.553976  
## [378] train-rmse:0.553918  
## [379] train-rmse:0.553854  
## [380] train-rmse:0.553746  
## [381] train-rmse:0.553629  
## [382] train-rmse:0.553549  
## [383] train-rmse:0.553412  
## [384] train-rmse:0.553356  
## [385] train-rmse:0.553223  
## [386] train rmse:0.553169  
## [387] train rmse:0.553121  
## [388] train rmse:0.553081  
## [389] train rmse:0.552938  
## [390] train rmse:0.552853  
## [391] train rmse:0.552719  
## [392] train rmse:0.552650 ## [393]  
train rmse:0.552510  
## [394] train rmse:0.552480  
## [395] train rmse:0.552450  
## [396] train rmse:0.552421  
## [397] train rmse:0.552342  
## [398] train rmse:0.552238  
## [399] train rmse:0.552207  
## [400] train-rmse:0.552181

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## [401] train-rmse:0.552071  
## [402] train-rmse:0.551949  
## [403] train-rmse:0.551767  
## [404] train-rmse:0.551709  
## [405] train-rmse:0.551691  
## [406] train-rmse:0.551578  
## [407] train-rmse:0.551509  
## [408] train-rmse:0.551392  
## [409] train-rmse:0.551279  
## [410] train-rmse:0.551096  
## [411] train-rmse:0.551060  
## [412] train-rmse:0.550971  
## [413] train-rmse:0.550763  
## [414] train-rmse:0.550665  
## [415] train-rmse:0.550603  
## [416] train-rmse:0.550536  
## [417] train-rmse:0.550331  
## [418] train-rmse:0.550272  
## [419] train-rmse:0.550136  
## [420] train-rmse:0.549949  
## [421] train-rmse:0.549896  
## [422] train-rmse:0.549868  
## [423] train-rmse:0.549717  
## [424] train-rmse:0.549657  
## [425] train-rmse:0.549567  
## [426] train-rmse:0.549548  
## [427] train-rmse:0.549388  
## [428] train-rmse:0.549327  
## [429] train-rmse:0.549277

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## [430] train-rmse:0.549233  
## [431] train-rmse:0.549078  
## [432] train-rmse:0.549023  
## [433] train-rmse:0.548962  
## [434] train-rmse:0.548892  
## [435] train-rmse:0.548858 ## [436]  
train rmse:0.548772  
## [437] train rmse:0.548772  
## [438] train rmse:0.548654  
## [439] train rmse:0.548584  
## [440] train rmse:0.548523  
## [441] train rmse:0.548412  
## [442] train rmse:0.548341 ## [443]  
train rmse:0.548245  
## [444] train rmse:0.548136  
## [445] train rmse:0.548052  
## [446] train rmse:0.548010  
## [447] train rmse:0.547901  
## [448] train rmse:0.547776  
## [449] train rmse:0.547683  
## [450] train-rmse:0.547614  
## [451] train-rmse:0.547494  
## [452] train-rmse:0.547424  
## [453] train-rmse:0.547309  
## [454] train-rmse:0.547231  
## [455] train-rmse:0.547125  
## [456] train-rmse:0.547096  
## [457] train-rmse:0.546976  
## [458] train-rmse:0.546965

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## [459] train-rmse:0.546796  
## [460] train-rmse:0.546715  
## [461] train-rmse:0.546662  
## [462] train-rmse:0.546594  
## [463] train-rmse:0.546501  
## [464] train-rmse:0.546454  
## [465] train-rmse:0.546288  
## [466] train-rmse:0.546263  
## [467] train-rmse:0.546225  
## [468] train-rmse:0.546218  
## [469] train-rmse:0.546099  
## [470] train-rmse:0.546047  
## [471] train-rmse:0.545994  
## [472] train-rmse:0.545922  
## [473] train-rmse:0.545776  
## [474] train-rmse:0.545734  
## [475] train-rmse:0.545630  
## [476] train-rmse:0.545525  
## [477] train-rmse:0.545466  
## [478] train-rmse:0.545346  
## [479] train-rmse:0.545331  
## [480] train-rmse:0.545262  
## [481] train-rmse:0.545179  
## [482] train-rmse:0.545171  
## [483] train-rmse:0.545155  
## [484] train-rmse:0.545071  
## [485] train-rmse:0.544995  
## [486] train rmse:0.544910  
## [487] train rmse:0.544793

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## [488] train rmse:0.544680  
## [489] train rmse:0.544626  
## [490] train rmse:0.544590  
## [491] train rmse:0.544540  
## [492] train rmse:0.544515

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## [493] train rmse:0.544345  
## [494] train rmse:0.544249  
## [495] train rmse:0.544162  
## [496] train rmse:0.544128 ## [497]  
train-rmse:0.544101 ## [498] train-  
rmse:0.543890  
## [499] train-rmse:0.543837  
## [500] train-rmse:0.543815  
## [501] train-rmse:0.543781  
## [502] train-rmse:0.543721  
## [503] train-rmse:0.543678  
## [504] train-rmse:0.543575  
## [505] train-rmse:0.543475  
## [506] train-rmse:0.543393  
## [507] train-rmse:0.543257  
## [508] train-rmse:0.543130  
## [509] train-rmse:0.543087  
## [510] train-rmse:0.542961  
## [511] train-rmse:0.542855  
## [512] train-rmse:0.542797  
## [513] train-rmse:0.542762  
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## [519] train-rmse:0.542433  
## [520] train-rmse:0.542296

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## [521] train-rmse:0.542243
## [522] train-rmse:0.542168
## [523] train-rmse:0.542015
## [524] train-rmse:0.541921
## [525] train-rmse:0.541842
## [526] train-rmse:0.541781
## [527] train-rmse:0.541757
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## [533] train-rmse:0.541232
## [534] train-rmse:0.541218
## [535] train-rmse:0.541164 ## [536]
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rmse:0.540986
## [538] train rmse:0.540904
## [539] train rmse:0.540839
## [540] train rmse:0.540684
## [541] train rmse:0.540565
## [542] train rmse:0.540545 ## [543]
train rmse:0.540489
## [544] train-rmse:0.540452
## [545] train-rmse:0.540288
## [546] train-rmse:0.540197
## [547] train-rmse:0.540041
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## [548] train-rmse:0.539919  
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## [550] train-rmse:0.539840  
## [551] train-rmse:0.539822  
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## [572] train-rmse:0.538426  
## [573] train-rmse:0.538404  
## [574] train-rmse:0.538377

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## [575] train-rmse:0.538313
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## [577] train-rmse:0.538198
## [578] train-rmse:0.538107
## [579] train-rmse:0.538055
## [580] train-rmse:0.537983
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## [588] train-rmse:0.537382
## [589] train-rmse:0.537264 ## [590]
train-rmse:0.537203 ## [591] train
rmse:0.537145
## [592] train rmse:0.537122 ## [593]
train rmse:0.537040
## [594] train rmse:0.536954
## [595] train rmse:0.536858
## [596] train rmse:0.536813
## [597] train rmse:0.536747 ## [598]
train-rmse:0.536673 ## [599] train-
rmse:0.536609
## [600] train-rmse:0.536492
## [601] train-rmse:0.536402
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## [602] train-rmse:0.536386  
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## [625] train-rmse:0.535011  
## [626] train-rmse:0.534940  
## [627] train-rmse:0.534874  
## [628] train-rmse:0.534766

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## [629] train-rmse:0.534766  
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## [640] train-rmse:0.534232  
## [641] train rmse:0.534223  
## [642] train rmse:0.534201

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## [643] train rmse:0.534177  
## [644] train rmse:0.534070  
## [645] train rmse:0.534006  
## [646] train rmse:0.533954  
## [647] train rmse:0.533922  
## [648] train rmse:0.533918  
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## [666] train-rmse:0.532906  
## [667] train-rmse:0.532876  
## [668] train-rmse:0.532781  
## [669] train-rmse:0.532761

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## [670] train-rmse:0.532688  
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## [688] train-rmse:0.531629  
## [689] train-rmse:0.531565  
## [690] train-rmse:0.531516 ## [691]  
train-rmse:0.531509 ## [692] train  
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rmse:0.531455  
## [694] train rmse:0.531429  
## [695] train rmse:0.531402  
## [696] train rmse:0.531317

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## [697] train rmse:0.531208  
## [698] train rmse:0.531100  
## [699] train rmse:0.531042  
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## [706] train-rmse:0.530627  
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## [714] train-rmse:0.530138  
## [715] train-rmse:0.530090  
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## [718] train-rmse:0.529978  
## [719] train-rmse:0.529897  
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## [721] train-rmse:0.529871  
## [722] train-rmse:0.529805  
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## [724] train-rmse:0.529658  
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## [726] train-rmse:0.529579  
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## [738] train-rmse:0.528883  
## [739] train-rmse:0.528807  
## [740] train-rmse:0.528792  
## [741] train-rmse:0.528753  
## [742] train rmse:0.528685 ## [743]  
train rmse:0.528521  
## [744] train rmse:0.528467  
## [745] train rmse:0.528444  
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## [747] train rmse:0.528360  
## [748] train rmse:0.528303  
## [749] train rmse:0.528226  
## [750] train rmse:0.528208

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## [6] train-rmse:1.074865  
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## [26] train-rmse:0.843099  
## [27] train-rmse:0.835254

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## [43] train-rmse:0.742665  
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## [64] train-rmse:0.680115  
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## [66] train-rmse:0.676253  
## [67] train-rmse:0.674402  
## [68] train-rmse:0.672629  
## [69] train-rmse:0.670927

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## [70] train-rmse:0.669272
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## [72] train-rmse:0.666204
## [73] train-rmse:0.664707
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## [95] train-rmse:0.640184
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## [98] train-rmse:0.637713
## [99] train-rmse:0.636965
## [100] train-rmse:0.636248
## [101] train-rmse:0.635633
## [102] train-rmse:0.635014
## [103] train-rmse:0.634347
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## [104] train-rmse:0.633661
## [105] train-rmse:0.633024
## [106] train-rmse:0.632436
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## [110] train-rmse:0.630256
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## [122] train-rmse:0.624199
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## [125] train-rmse:0.622745
## [126] train-rmse:0.622401
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## [136] train-rmse:0.618627
## [137] train-rmse:0.618291
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## [138] train-rmse:0.617896 ## [139]
train-rmse:0.617521 ## [140] train-
rmse:0.617175
## [141] train rmse:0.616731
## [142] train rmse:0.616292 ## [143]
train rmse:0.615962
## [144] train rmse:0.615580
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## [146] train rmse:0.614831 ## [147]
train-rmse:0.614453 ## [148] train-
rmse:0.614104
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## [151] train-rmse:0.613284
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## [159] train-rmse:0.611006
## [160] train-rmse:0.610565
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## [166] train-rmse:0.608963
## [167] train-rmse:0.608656
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## [169] train-rmse:0.608147
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## [171] train-rmse:0.607743
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## [172] train-rmse:0.607534
## [173] train-rmse:0.607331
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## [186] train-rmse:0.604267
## [187] train-rmse:0.604038
## [188] train rmse:0.603890
## [189] train rmse:0.603597
## [190] train rmse:0.603413
## [191] train rmse:0.603273
## [192] train rmse:0.602997
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## [193] train rmse:0.602875  
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## [199] train-rmse:0.601697  
## [200] train-rmse:0.601416  
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## [220] train-rmse:0.597688  
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## [237] train-rmse:0.594862  
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## [239] train-rmse:0.594575 ## [240]  
train-rmse:0.594427 ## [241] train  
rmse:0.594235  
## [242] train rmse:0.594116 ## [243]  
train rmse:0.594045  
## [244] train rmse:0.593901  
## [245] train rmse:0.593834  
## [246] train rmse:0.593639  
## [247] train rmse:0.593579

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## [248] train rmse:0.593321  
## [249] train-rmse:0.593224  
## [250] train-rmse:0.593109  
## [251] train-rmse:0.592970  
## [252] train-rmse:0.592904  
## [253] train-rmse:0.592777  
## [254] train-rmse:0.592667  
## [255] train-rmse:0.592486  
## [256] train-rmse:0.592403  
## [257] train-rmse:0.592267  
## [258] train-rmse:0.591995  
## [259] train-rmse:0.591856  
## [260] train-rmse:0.591730  
## [261] train-rmse:0.591661  
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## [264] train-rmse:0.591307  
## [265] train-rmse:0.591108  
## [266] train-rmse:0.590968  
## [267] train-rmse:0.590773  
## [268] train-rmse:0.590564  
## [269] train-rmse:0.590369  
## [270] train-rmse:0.590236  
## [271] train-rmse:0.590100  
## [272] train-rmse:0.589955  
## [273] train-rmse:0.589842  
## [274] train-rmse:0.589655  
## [275] train-rmse:0.589508

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## [276] train-rmse:0.589458  
## [277] train-rmse:0.589334  
## [278] train-rmse:0.589183  
## [279] train-rmse:0.589054  
## [280] train-rmse:0.589022  
## [281] train-rmse:0.588922  
## [282] train-rmse:0.588825  
## [283] train-rmse:0.588666  
## [284] train-rmse:0.588555  
## [285] train-rmse:0.588430  
## [286] train-rmse:0.588220  
## [287] train-rmse:0.588021  
## [288] train rmse:0.587859  
## [289] train rmse:0.587654  
## [290] train rmse:0.587501  
## [291] train rmse:0.587445  
## [292] train rmse:0.587344 ## [293]  
train rmse:0.587223  
## [294] train rmse:0.587074  
## [295] train rmse:0.587011  
## [296] train rmse:0.586910  
## [297] train rmse:0.586834  
## [298] train rmse:0.586704  
## [299] train-rmse:0.586573  
## [300] train-rmse:0.586461  
## [301] train-rmse:0.586442  
## [302] train-rmse:0.586364  
## [303] train-rmse:0.586217

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## [304] train-rmse:0.586030  
## [305] train-rmse:0.585878  
## [306] train-rmse:0.585828  
## [307] train-rmse:0.585627  
## [308] train-rmse:0.585586  
## [309] train-rmse:0.585398  
## [310] train-rmse:0.585261  
## [311] train-rmse:0.585162  
## [312] train-rmse:0.585073  
## [313] train-rmse:0.584989  
## [314] train-rmse:0.584833  
## [315] train-rmse:0.584768  
## [316] train-rmse:0.584609  
## [317] train-rmse:0.584470  
## [318] train-rmse:0.584433  
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## [325] train-rmse:0.583554  
## [326] train-rmse:0.583455  
## [327] train-rmse:0.583352  
## [328] train-rmse:0.583221  
## [329] train-rmse:0.583081  
## [330] train-rmse:0.582932  
## [331] train-rmse:0.582914

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## [332] train-rmse:0.582874  
## [333] train-rmse:0.582791  
## [334] train-rmse:0.582708  
## [335] train-rmse:0.582570  
## [336] train-rmse:0.582435  
## [337] train-rmse:0.582337  
## [338] train-rmse:0.582263  
## [339] train-rmse:0.582135  
## [340] train-rmse:0.582011 ## [341]  
train-rmse:0.581820 ## [342] train  
rmse:0.581747 ## [343] train  
rmse:0.581621  
## [344] train rmse:0.581482  
## [345] train rmse:0.581387  
## [346] train rmse:0.581306  
## [347] train rmse:0.581161  
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## [354] train-rmse:0.580471  
## [355] train-rmse:0.580358  
## [356] train-rmse:0.580216  
## [357] train-rmse:0.580092  
## [358] train-rmse:0.580005  
## [359] train-rmse:0.579935

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## [360] train-rmse:0.579892  
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## [367] train-rmse:0.579345  
## [368] train-rmse:0.579228  
## [369] train-rmse:0.579174  
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## [374] train-rmse:0.578605  
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## [377] train-rmse:0.578467  
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## [379] train-rmse:0.578236  
## [380] train-rmse:0.578096  
## [381] train-rmse:0.578054  
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## [383] train-rmse:0.577733  
## [384] train-rmse:0.577659  
## [385] train-rmse:0.577491  
## [386] train-rmse:0.577457  
## [387] train-rmse:0.577267

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## [388] train rmse:0.577149  
## [389] train rmse:0.577127  
## [390] train rmse:0.577078  
## [391] train rmse:0.577004  
## [392] train rmse:0.576918

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## [393] train rmse:0.576883  
## [394] train rmse:0.576764 ## [395]  
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rmse:0.576614  
## [397] train-rmse:0.576560  
## [398] train-rmse:0.576479  
## [399] train-rmse:0.576357  
## [400] train-rmse:0.576271  
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## [402] train-rmse:0.576133  
## [403] train-rmse:0.576079  
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## [405] train-rmse:0.575828  
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## [407] train-rmse:0.575772  
## [408] train-rmse:0.575697  
## [409] train-rmse:0.575570  
## [410] train-rmse:0.575380  
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## [412] train-rmse:0.575285  
## [413] train-rmse:0.575236  
## [414] train-rmse:0.575137  
## [415] train-rmse:0.575070  
## [416] train-rmse:0.574955  
## [417] train-rmse:0.574932  
## [418] train-rmse:0.574799  
## [419] train-rmse:0.574776

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## [420] train-rmse:0.574711  
## [421] train-rmse:0.574630  
## [422] train-rmse:0.574496  
## [423] train-rmse:0.574393  
## [424] train-rmse:0.574267  
## [425] train-rmse:0.574221  
## [426] train-rmse:0.574121  
## [427] train-rmse:0.573948  
## [428] train-rmse:0.573845  
## [429] train-rmse:0.573743  
## [430] train-rmse:0.573598  
## [431] train-rmse:0.573497  
## [432] train-rmse:0.573431  
## [433] train-rmse:0.573386  
## [434] train-rmse:0.573288  
## [435] train-rmse:0.573102  
## [436] train-rmse:0.573024  
## [437] train-rmse:0.572850  
## [438] train-rmse:0.572814  
## [439] train-rmse:0.572734  
## [440] train-rmse:0.572667  
## [441] train-rmse:0.572599  
## [442] train-rmse:0.572504 ## [443]  
train rmse:0.572475  
## [444] train rmse:0.572310  
## [445] train rmse:0.572234  
## [446] train rmse:0.572138  
## [447] train-rmse:0.572067

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## [448] train-rmse:0.571988  
## [449] train-rmse:0.571889  
## [450] train-rmse:0.571659  
## [451] train-rmse:0.571559  
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## [454] train-rmse:0.571113  
## [455] train-rmse:0.571069  
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## [458] train-rmse:0.570670  
## [459] train-rmse:0.570499  
## [460] train-rmse:0.570450  
## [461] train-rmse:0.570383  
## [462] train-rmse:0.570269  
## [463] train-rmse:0.570199  
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## [467] train-rmse:0.569813  
## [468] train-rmse:0.569777  
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## [470] train-rmse:0.569474  
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## [472] train-rmse:0.569210  
## [473] train-rmse:0.569085  
## [474] train-rmse:0.568934  
## [475] train-rmse:0.568846

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## [476] train-rmse:0.568765  
## [477] train-rmse:0.568711  
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## [479] train-rmse:0.568583  
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## [481] train-rmse:0.568432  
## [482] train-rmse:0.568300  
## [483] train-rmse:0.568210  
## [484] train-rmse:0.568051  
## [485] train-rmse:0.567839  
## [486] train-rmse:0.567747  
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## [488] train rmse:0.567552  
## [489] train rmse:0.567523  
## [490] train rmse:0.567449  
## [491] train rmse:0.567348  
## [492] train rmse:0.567167 ## [493]  
train rmse:0.567113  
## [494] train rmse:0.566961  
## [495] train rmse:0.566898 ## [496]  
train-rmse:0.566825 ## [497] train-  
rmse:0.566685  
## [498] train-rmse:0.566595  
## [499] train-rmse:0.566415  
## [500] train-rmse:0.566387  
## [501] train-rmse:0.566255  
## [502] train-rmse:0.566154  
## [503] train-rmse:0.566100

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## [504] train-rmse:0.566066  
## [505] train-rmse:0.565952  
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## [507] train-rmse:0.565871  
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## [509] train-rmse:0.565668  
## [510] train-rmse:0.565565  
## [511] train-rmse:0.565423  
## [512] train-rmse:0.565250  
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## [514] train-rmse:0.565057  
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## [516] train-rmse:0.564895  
## [517] train-rmse:0.564807  
## [518] train-rmse:0.564794  
## [519] train-rmse:0.564748  
## [520] train-rmse:0.564609  
## [521] train-rmse:0.564574  
## [522] train-rmse:0.564487  
## [523] train-rmse:0.564356  
## [524] train-rmse:0.564312  
## [525] train-rmse:0.564144  
## [526] train-rmse:0.564144  
## [527] train-rmse:0.564022  
## [528] train-rmse:0.563968  
## [529] train-rmse:0.563889  
## [530] train-rmse:0.563746  
## [531] train-rmse:0.563634

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## [532] train-rmse:0.563571  
## [533] train-rmse:0.563544  
## [534] train-rmse:0.563476  
## [535] train-rmse:0.563344 ## [536]  
train-rmse:0.563291  
## [537] train-rmse:0.563196  
## [538] train-rmse:0.563180  
## [539] train-rmse:0.563180  
## [540] train rmse:0.563099  
## [541] train rmse:0.563008  
## [542] train rmse:0.562998

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## [543] train-rmse:0.562872
## [544] train-rmse:0.562825
## [545] train-rmse:0.562815
## [546] train-rmse:0.562771
## [547] train-rmse:0.562758
## [548] train-rmse:0.562703
## [549] train-rmse:0.562658
## [550] train-rmse:0.562531
## [551] train-rmse:0.562433
## [552] train-rmse:0.562392
## [553] train-rmse:0.562279
## [554] train-rmse:0.562167
## [555] train-rmse:0.562140
## [556] train-rmse:0.562084
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## [558] train-rmse:0.561939
## [559] train-rmse:0.561922
## [560] train-rmse:0.561845
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## [562] train-rmse:0.561685
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## [564] train-rmse:0.561552
## [565] train-rmse:0.561539
## [566] train-rmse:0.561531
## [567] train-rmse:0.561413
## [568] train-rmse:0.561290
## [569] train-rmse:0.561188
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## [570] train-rmse:0.561181  
## [571] train-rmse:0.561130  
## [572] train-rmse:0.561121  
## [573] train-rmse:0.561004  
## [574] train-rmse:0.560959  
## [575] train-rmse:0.560891  
## [576] train-rmse:0.560787  
## [577] train-rmse:0.560646  
## [578] train-rmse:0.560622  
## [579] train-rmse:0.560457  
## [580] train-rmse:0.560405  
## [581] train-rmse:0.560235  
## [582] train-rmse:0.560134  
## [583] train-rmse:0.560047  
## [584] train-rmse:0.559913  
## [585] train-rmse:0.559834  
## [586] train-rmse:0.559798  
## [587] train-rmse:0.559644  
## [588] train-rmse:0.559635 ## [589]  
train-rmse:0.559542 ## [590] train  
rmse:0.559399  
## [591] train rmse:0.559238  
## [592] train rmse:0.559182 ## [593]  
train rmse:0.559081  
## [594] train rmse:0.559030  
## [595] train rmse:0.558967

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## [596] train rmse:0.558919 ## [597]  
train-rmse:0.558825 ## [598] train-  
rmse:0.558711  
## [599] train-rmse:0.558683  
## [600] train-rmse:0.558617  
## [601] train-rmse:0.558536  
## [602] train-rmse:0.558516  
## [603] train-rmse:0.558427  
## [604] train-rmse:0.558367  
## [605] train-rmse:0.558367  
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## [607] train-rmse:0.558209  
## [608] train-rmse:0.558146  
## [609] train-rmse:0.558088  
## [610] train-rmse:0.558051  
## [611] train-rmse:0.557993  
## [612] train-rmse:0.557859  
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## [615] train-rmse:0.557640  
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## [618] train-rmse:0.557409  
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## [621] train-rmse:0.557134  
## [622] train-rmse:0.557029  
## [623] train-rmse:0.557020

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## [624] train-rmse:0.556951  
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## [626] train-rmse:0.556741  
## [627] train-rmse:0.556674  
## [628] train-rmse:0.556536  
## [629] train-rmse:0.556518  
## [630] train-rmse:0.556393  
## [631] train-rmse:0.556324  
## [632] train-rmse:0.556288  
## [633] train-rmse:0.556214  
## [634] train-rmse:0.556091  
## [635] train-rmse:0.556016  
## [636] train-rmse:0.556005  
## [637] train-rmse:0.555868  
## [638] train-rmse:0.555809  
## [639] train-rmse:0.555779  
## [640] train rmse:0.555750  
## [641] train rmse:0.555631  
## [642] train rmse:0.555571 ## [643]  
train rmse:0.555512  
## [644] train rmse:0.555468  
## [645] train rmse:0.555400  
## [646] train rmse:0.555290  
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## [648] train-rmse:0.555261  
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## [650] train-rmse:0.555189  
## [651] train-rmse:0.555093

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## [652] train-rmse:0.554921  
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## [657] train-rmse:0.554474  
## [658] train-rmse:0.554419  
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## [664] train-rmse:0.554204  
## [665] train-rmse:0.554204  
## [666] train-rmse:0.554204  
## [667] train-rmse:0.554092  
## [668] train-rmse:0.554006  
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## [670] train-rmse:0.553877  
## [671] train-rmse:0.553782  
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## [674] train-rmse:0.553588  
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## [677] train-rmse:0.553371  
## [678] train-rmse:0.553340  
## [679] train-rmse:0.553225

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## [680] train-rmse:0.553208  
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## [684] train-rmse:0.552883  
## [685] train-rmse:0.552783  
## [686] train-rmse:0.552749  
## [687] train-rmse:0.552588  
## [688] train-rmse:0.552468  
## [689] train-rmse:0.552331 ## [690]  
train-rmse:0.552265 ## [691] train  
rmse:0.552153  
## [692] train rmse:0.552098

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## [693] train rmse:0.551968  
## [694] train rmse:0.551954  
## [695] train rmse:0.551860  
## [696] train rmse:0.551748  
## [697] train rmse:0.551588  
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## [717] train-rmse:0.550177  
## [718] train-rmse:0.550149  
## [719] train-rmse:0.550089

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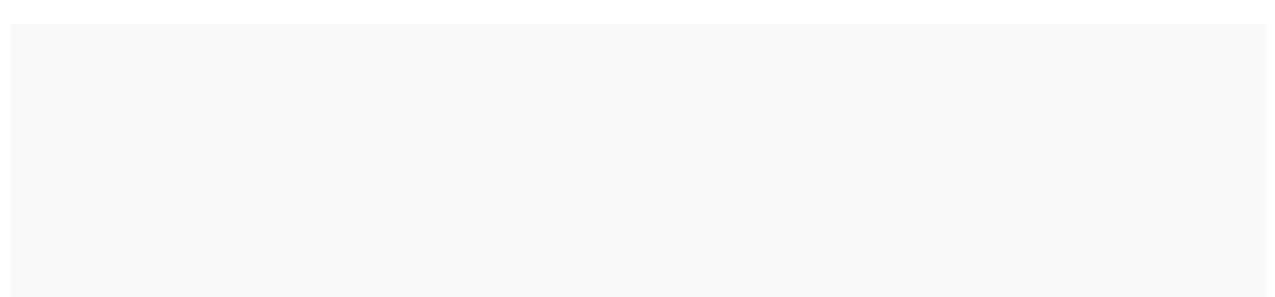


```
## [720] train-rmse:0.550059
## [721] train-rmse:0.549973
## [722] train-rmse:0.549923
## [723] train-rmse:0.549874
## [724] train-rmse:0.549832
## [725] train-rmse:0.549791
## [726] train-rmse:0.549711
## [727] train-rmse:0.549669
## [728] train-rmse:0.549607
## [729] train-rmse:0.549484
## [730] train-rmse:0.549451
## [731] train-rmse:0.549386
## [732] train-rmse:0.549289
## [733] train-rmse:0.549228
## [734] train-rmse:0.549190
## [735] train-rmse:0.549114
## [736] train-rmse:0.549058
## [737] train-rmse:0.549031
## [738] train-rmse:0.548999
## [739] train-rmse:0.548954
## [740] train-rmse:0.548874
## [741] train rmse:0.548721
## [742] train rmse:0.548647 ## [743]
train rmse:0.548602
## [744] train rmse:0.548563
## [745] train rmse:0.548532
## [746] train rmse:0.548457
```

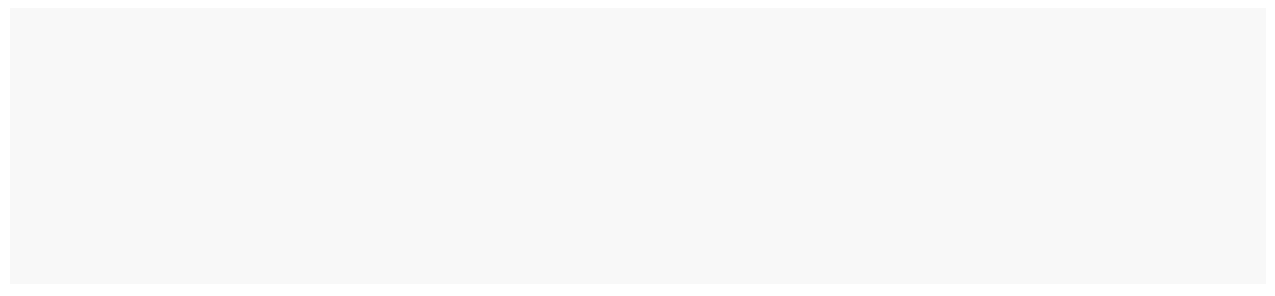
```
## [747] train rmse:0.548445
## [748] train-rmse:0.548392
## [749] train-rmse:0.548288
## [750] train-rmse:0.548217
## [1] train-rmse:1.197026
## [2] train-rmse:1.178051
## [3] train-rmse:1.159671
## [4] train-rmse:1.141825
## [5] train-rmse:1.124480
## [6] train-rmse:1.107832
## [7] train-rmse:1.091675
## [8] train-rmse:1.075699
## [9] train-rmse:1.060577
## [10] train-rmse:1.045904
## [11] train-rmse:1.031827
## [12] train-rmse:1.018114
## [13] train-rmse:1.004731
## [14] train-rmse:0.991977
## [15] train-rmse:0.979595
## [16] train-rmse:0.967661
## [17] train-rmse:0.956062
## [18] train-rmse:0.944796
## [19] train-rmse:0.934093
## [20] train-rmse:0.923795
## [21] train-rmse:0.913696
## [22] train-rmse:0.904029
## [23] train-rmse:0.894772
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## [24] train-rmse:0.885949
## [25] train-rmse:0.877362
## [26] train-rmse:0.869010
## [27] train-rmse:0.861044
## [28] train-rmse:0.853233
## [29] train-rmse:0.845857
## [30] train-rmse:0.838656
## [31] train-rmse:0.831775
## [32] train-rmse:0.825014
## [33] train-rmse:0.818587
## [34] train-rmse:0.812539
## [35] train-rmse:0.806648
## [36] train-rmse:0.800992
## [37] train-rmse:0.795542
## [38] train-rmse:0.790206
## [39] train-rmse:0.785085
## [40] train-rmse:0.779874
## [41] train-rmse:0.774906
## [42] train-rmse:0.770240
## [43] train-rmse:0.765683
## [44] train-rmse:0.761345
## [45] train-rmse:0.757230
## [46] train-rmse:0.753217
## [47] train-rmse:0.749472
## [48] train-rmse:0.745785
## [49] train-rmse:0.742329
## [50] train-rmse:0.738902
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## [51] train-rmse:0.735452
## [52] train-rmse:0.732359
## [53] train-rmse:0.729296
## [54] train-rmse:0.726333
## [55] train-rmse:0.723467
## [56] train-rmse:0.720552
## [57] train-rmse:0.717843
## [58] train-rmse:0.715298
## [59] train-rmse:0.712859
## [60] train-rmse:0.710421
## [61] train-rmse:0.708144
## [62] train-rmse:0.705961
## [63] train-rmse:0.703670
## [64] train-rmse:0.701651
## [65] train-rmse:0.699604
## [66] train-rmse:0.697843
## [67] train-rmse:0.696019
## [68] train-rmse:0.694244
## [69] train-rmse:0.692408
## [70] train-rmse:0.690776
## [71] train-rmse:0.689162
## [72] train-rmse:0.687492
## [73] train-rmse:0.685975
## [74] train-rmse:0.684430
## [75] train-rmse:0.682960
## [76] train-rmse:0.681454
## [77] train-rmse:0.680061
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## [78] train-rmse:0.678624
## [79] train-rmse:0.677380
## [80] train-rmse:0.676107
## [81] train-rmse:0.674808
## [82] train-rmse:0.673596
## [83] train-rmse:0.672441
## [84] train-rmse:0.671316
## [85] train-rmse:0.670122
## [86] train-rmse:0.669113
## [87] train-rmse:0.668073
## [88] train-rmse:0.667077
## [89] train-rmse:0.666077
## [90] train-rmse:0.665224
## [91] train-rmse:0.664218
## [92] train-rmse:0.663404
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## [93] train-rmse:0.662565
## [94] train-rmse:0.661658
## [95] train-rmse:0.660785
## [96] train-rmse:0.660040
## [97] train-rmse:0.659166
## [98] train-rmse:0.658354
## [99] train-rmse:0.657575
## [100] train-rmse:0.656798
## [101] train-rmse:0.656188
## [102] train-rmse:0.655489
## [103] train-rmse:0.654844
## [104] train-rmse:0.654146
## [105] train-rmse:0.653519
## [106] train-rmse:0.652806
## [107] train-rmse:0.652167
## [108] train-rmse:0.651531
## [109] train-rmse:0.650902
## [110] train-rmse:0.650311
## [111] train-rmse:0.649728
## [112] train-rmse:0.649150
## [113] train-rmse:0.648583
## [114] train-rmse:0.648093
## [115] train-rmse:0.647559
## [116] train-rmse:0.647007
## [117] train-rmse:0.646552
## [118] train-rmse:0.646008
## [119] train-rmse:0.645562
## [120] train-rmse:0.645068
## [121] train-rmse:0.644611
## [122] train-rmse:0.644122
## [123] train-rmse:0.643657
## [124] train-rmse:0.643298
## [125] train-rmse:0.642868
## [126] train-rmse:0.642476
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## [127] train-rmse:0.642040  
## [128] train-rmse:0.641674  
## [129] train-rmse:0.641289  
## [130] train-rmse:0.640936  
## [131] train-rmse:0.640572  
## [132] train-rmse:0.640196  
## [133] train-rmse:0.639831  
## [134] train-rmse:0.639499  
## [135] train-rmse:0.639100  
## [136] train-rmse:0.638743  
## [137] train-rmse:0.638416 ## [138]  
train-rmse:0.638094 ## [139] train-  
rmse:0.637766  
## [140] train rmse:0.637444  
## [141] train rmse:0.637091  
## [142] train rmse:0.636712 ## [143]  
train rmse:0.636384  
## [144] train rmse:0.636076  
## [145] train rmse:0.635711 ## [146]  
train-rmse:0.635370 ## [147] train-  
rmse:0.635086  
## [148] train-rmse:0.634784  
## [149] train-rmse:0.634595  
## [150] train-rmse:0.634366  
## [151] train-rmse:0.634089  
## [152] train-rmse:0.633709  
## [153] train-rmse:0.633269  
## [154] train-rmse:0.632971

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## [155] train-rmse:0.632644  
## [156] train-rmse:0.632391  
## [157] train-rmse:0.632158  
## [158] train-rmse:0.631899  
## [159] train-rmse:0.631599  
## [160] train-rmse:0.631388  
## [161] train-rmse:0.631154  
## [162] train-rmse:0.630910  
## [163] train-rmse:0.630649  
## [164] train-rmse:0.630441  
## [165] train-rmse:0.630203  
## [166] train-rmse:0.629947  
## [167] train-rmse:0.629690  
## [168] train-rmse:0.629452  
## [169] train-rmse:0.629171  
## [170] train-rmse:0.628873  
## [171] train-rmse:0.628585  
## [172] train-rmse:0.628284  
## [173] train-rmse:0.628040  
## [174] train-rmse:0.627821  
## [175] train-rmse:0.627539  
## [176] train-rmse:0.627220  
## [177] train-rmse:0.626989  
## [178] train-rmse:0.626780  
## [179] train-rmse:0.626591  
## [180] train-rmse:0.626278  
## [181] train-rmse:0.625994  
## [182] train-rmse:0.625783

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## [183] train-rmse:0.625534  
## [184] train-rmse:0.625356  
## [185] train-rmse:0.625260  
## [186] train-rmse:0.625157  
## [187] train rmse:0.624925  
## [188] train rmse:0.624759  
## [189] train rmse:0.624617  
## [190] train rmse:0.624312  
## [191] train rmse:0.624146  
## [192] train rmse:0.623913 ## [193]  
train rmse:0.623683  
## [194] train rmse:0.623445  
## [195] train rmse:0.623303  
## [196] train rmse:0.623073  
## [197] train rmse:0.622847  
## [198] train rmse:0.622637  
## [199] train rmse:0.622459  
## [200] train rmse:0.622278  
## [201] train-rmse:0.622010  
## [202] train-rmse:0.621762  
## [203] train-rmse:0.621631  
## [204] train-rmse:0.621506  
## [205] train-rmse:0.621337  
## [206] train-rmse:0.621265  
## [207] train-rmse:0.621059  
## [208] train-rmse:0.620876  
## [209] train-rmse:0.620593  
## [210] train-rmse:0.620365

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## [211] train-rmse:0.620279  
## [212] train-rmse:0.620150  
## [213] train-rmse:0.619959  
## [214] train-rmse:0.619778  
## [215] train-rmse:0.619530  
## [216] train-rmse:0.619365  
## [217] train-rmse:0.619079  
## [218] train-rmse:0.618993  
## [219] train-rmse:0.618853  
## [220] train-rmse:0.618724  
## [221] train-rmse:0.618499  
## [222] train-rmse:0.618439  
## [223] train-rmse:0.618315  
## [224] train-rmse:0.618161  
## [225] train-rmse:0.618038  
## [226] train-rmse:0.617857  
## [227] train-rmse:0.617628  
## [228] train-rmse:0.617443  
## [229] train-rmse:0.617392  
## [230] train-rmse:0.617187  
## [231] train-rmse:0.617036  
## [232] train-rmse:0.616826  
## [233] train-rmse:0.616686  
## [234] train-rmse:0.616585  
## [235] train-rmse:0.616387  
## [236] train-rmse:0.616297  
## [237] train-rmse:0.616215

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## [238] train-rmse:0.615978 ## [239]  
train-rmse:0.615894 ## [240] train  
rmse:0.615832  
## [241] train rmse:0.615680  
## [242] train rmse:0.615396

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## [243] train rmse:0.615237  
## [244] train rmse:0.615037  
## [245] train rmse:0.614818  
## [246] train rmse:0.614594  
## [247] train rmse:0.614528  
## [248] train rmse:0.614460  
## [249] train rmse:0.614260  
## [250] train rmse:0.614062  
## [251] train-rmse:0.613989  
## [252] train-rmse:0.613921  
## [253] train-rmse:0.613794  
## [254] train-rmse:0.613704  
## [255] train-rmse:0.613569  
## [256] train-rmse:0.613431  
## [257] train-rmse:0.613310  
## [258] train-rmse:0.613207  
## [259] train-rmse:0.613091  
## [260] train-rmse:0.613023  
## [261] train-rmse:0.612881  
## [262] train-rmse:0.612695  
## [263] train-rmse:0.612630  
## [264] train-rmse:0.612583  
## [265] train-rmse:0.612490  
## [266] train-rmse:0.612355  
## [267] train-rmse:0.612285  
## [268] train-rmse:0.612222  
## [269] train-rmse:0.612175

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## [270] train-rmse:0.612084  
## [271] train-rmse:0.611941  
## [272] train-rmse:0.611870  
## [273] train-rmse:0.611713  
## [274] train-rmse:0.611607  
## [275] train-rmse:0.611477  
## [276] train-rmse:0.611404  
## [277] train-rmse:0.611273  
## [278] train-rmse:0.611164  
## [279] train-rmse:0.611075  
## [280] train-rmse:0.610979  
## [281] train-rmse:0.610880  
## [282] train-rmse:0.610750  
## [283] train-rmse:0.610555  
## [284] train-rmse:0.610449  
## [285] train-rmse:0.610336  
## [286] train-rmse:0.610216  
## [287] train rmse:0.610052  
## [288] train rmse:0.609869  
## [289] train rmse:0.609748  
## [290] train rmse:0.609525  
## [291] train rmse:0.609431  
## [292] train rmse:0.609306 ## [293]  
train rmse:0.609139  
## [294] train rmse:0.609063  
## [295] train rmse:0.608999  
## [296] train rmse:0.608854

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## [297] train rmse:0.608792  
## [298] train rmse:0.608723  
## [299] train rmse:0.608612  
## [300] train rmse:0.608448  
## [301] train-rmse:0.608390  
## [302] train-rmse:0.608356  
## [303] train-rmse:0.608210  
## [304] train-rmse:0.608155  
## [305] train-rmse:0.608051  
## [306] train-rmse:0.607913  
## [307] train-rmse:0.607837  
## [308] train-rmse:0.607706  
## [309] train-rmse:0.607507  
## [310] train-rmse:0.607337  
## [311] train-rmse:0.607274  
## [312] train-rmse:0.607146  
## [313] train-rmse:0.607098  
## [314] train-rmse:0.607068  
## [315] train-rmse:0.607002  
## [316] train-rmse:0.606902  
## [317] train-rmse:0.606799  
## [318] train-rmse:0.606681  
## [319] train-rmse:0.606655  
## [320] train-rmse:0.606547  
## [321] train-rmse:0.606431  
## [322] train-rmse:0.606318  
## [323] train-rmse:0.606225

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## [324] train-rmse:0.606115  
## [325] train-rmse:0.605972  
## [326] train-rmse:0.605773  
## [327] train-rmse:0.605591  
## [328] train-rmse:0.605482  
## [329] train-rmse:0.605430  
## [330] train-rmse:0.605261  
## [331] train-rmse:0.605173  
## [332] train-rmse:0.605079  
## [333] train-rmse:0.604959  
## [334] train-rmse:0.604834  
## [335] train-rmse:0.604631  
## [336] train-rmse:0.604485  
## [337] train-rmse:0.604426  
## [338] train-rmse:0.604246  
## [339] train-rmse:0.604141 ## [340]  
train-rmse:0.604014 ## [341] train  
rmse:0.603852  
## [342] train rmse:0.603806 ## [343]  
train rmse:0.603722  
## [344] train rmse:0.603614  
## [345] train rmse:0.603469  
## [346] train rmse:0.603401  
## [347] train rmse:0.603335  
## [348] train-rmse:0.603203  
## [349] train-rmse:0.603106  
## [350] train-rmse:0.603035

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## [351] train-rmse:0.602994  
## [352] train-rmse:0.602899  
## [353] train-rmse:0.602858  
## [354] train-rmse:0.602766  
## [355] train-rmse:0.602706  
## [356] train-rmse:0.602569  
## [357] train-rmse:0.602520  
## [358] train-rmse:0.602441  
## [359] train-rmse:0.602231  
## [360] train-rmse:0.602143  
## [361] train-rmse:0.602063  
## [362] train-rmse:0.601898  
## [363] train-rmse:0.601775  
## [364] train-rmse:0.601695  
## [365] train-rmse:0.601567  
## [366] train-rmse:0.601475  
## [367] train-rmse:0.601372  
## [368] train-rmse:0.601318  
## [369] train-rmse:0.601267  
## [370] train-rmse:0.601127  
## [371] train-rmse:0.601010  
## [372] train-rmse:0.600848  
## [373] train-rmse:0.600714  
## [374] train-rmse:0.600526  
## [375] train-rmse:0.600419  
## [376] train-rmse:0.600355  
## [377] train-rmse:0.600303

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## [378] train-rmse:0.600228  
## [379] train-rmse:0.600181  
## [380] train-rmse:0.600007  
## [381] train-rmse:0.599896  
## [382] train-rmse:0.599813  
## [383] train-rmse:0.599633  
## [384] train-rmse:0.599499  
## [385] train-rmse:0.599406  
## [386] train-rmse:0.599317  
## [387] train rmse:0.599182  
## [388] train rmse:0.599074  
## [389] train rmse:0.599031  
## [390] train rmse:0.598971  
## [391] train rmse:0.598836  
## [392] train rmse:0.598749

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## [393] train rmse:0.598652 ## [394]  
train-rmse:0.598571 ## [395] train-  
rmse:0.598390  
## [396] train-rmse:0.598334  
## [397] train-rmse:0.598169  
## [398] train-rmse:0.598072  
## [399] train-rmse:0.597987  
## [400] train-rmse:0.597958  
## [401] train-rmse:0.597913  
## [402] train-rmse:0.597835  
## [403] train-rmse:0.597802  
## [404] train-rmse:0.597613  
## [405] train-rmse:0.597479  
## [406] train-rmse:0.597385  
## [407] train-rmse:0.597308  
## [408] train-rmse:0.597255  
## [409] train-rmse:0.597192  
## [410] train-rmse:0.597114  
## [411] train-rmse:0.596960  
## [412] train-rmse:0.596816  
## [413] train-rmse:0.596696  
## [414] train-rmse:0.596663  
## [415] train-rmse:0.596591  
## [416] train-rmse:0.596480  
## [417] train-rmse:0.596335  
## [418] train-rmse:0.596284  
## [419] train-rmse:0.596158

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## [420] train-rmse:0.596068  
## [421] train-rmse:0.596039  
## [422] train-rmse:0.595914  
## [423] train-rmse:0.595896  
## [424] train-rmse:0.595863  
## [425] train-rmse:0.595794  
## [426] train-rmse:0.595753  
## [427] train-rmse:0.595682  
## [428] train-rmse:0.595526  
## [429] train-rmse:0.595424  
## [430] train-rmse:0.595301  
## [431] train-rmse:0.595123  
## [432] train-rmse:0.595047  
## [433] train-rmse:0.594975  
## [434] train-rmse:0.594808  
## [435] train-rmse:0.594686  
## [436] train-rmse:0.594594  
## [437] train-rmse:0.594534  
## [438] train-rmse:0.594494  
## [439] train-rmse:0.594269  
## [440] train-rmse:0.594207  
## [441] train-rmse:0.594137  
## [442] train rmse:0.594076 ## [443]  
train rmse:0.594054  
## [444] train rmse:0.593926  
## [445] train rmse:0.593787  
## [446] train rmse:0.593598  
## [447] train rmse:0.593422  
## [448] train rmse:0.593382

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## [449] train rmse:0.593258  
## [450] train-rmse:0.593179  
## [451] train-rmse:0.593119  
## [452] train-rmse:0.593003  
## [453] train-rmse:0.592994  
## [454] train-rmse:0.592911  
## [455] train-rmse:0.592837  
## [456] train-rmse:0.592705  
## [457] train-rmse:0.592571  
## [458] train-rmse:0.592505  
## [459] train-rmse:0.592416  
## [460] train-rmse:0.592249  
## [461] train-rmse:0.592158  
## [462] train-rmse:0.592004  
## [463] train-rmse:0.591962  
## [464] train-rmse:0.591898  
## [465] train-rmse:0.591747  
## [466] train-rmse:0.591695  
## [467] train-rmse:0.591671  
## [468] train-rmse:0.591565  
## [469] train-rmse:0.591422  
## [470] train-rmse:0.591363  
## [471] train-rmse:0.591340  
## [472] train-rmse:0.591256  
## [473] train-rmse:0.591092  
## [474] train-rmse:0.590923  
## [475] train-rmse:0.590814  
## [476] train-rmse:0.590685  
## [477] train-rmse:0.590572

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## [478] train-rmse:0.590529  
## [479] train-rmse:0.590507  
## [480] train-rmse:0.590453  
## [481] train-rmse:0.590382  
## [482] train-rmse:0.590259  
## [483] train-rmse:0.590172  
## [484] train-rmse:0.590094  
## [485] train-rmse:0.590024  
## [486] train-rmse:0.589956  
## [487] train rmse:0.589765  
## [488] train rmse:0.589681  
## [489] train rmse:0.589562  
## [490] train rmse:0.589525  
## [491] train rmse:0.589434  
## [492] train rmse:0.589428 ## [493]  
train rmse:0.589380  
## [494] train rmse:0.589284 ## [495]  
train-rmse:0.589194 ## [496] train-  
rmse:0.589152  
## [497] train-rmse:0.589098  
## [498] train-rmse:0.589035  
## [499] train-rmse:0.588955  
## [500] train-rmse:0.588920  
## [501] train-rmse:0.588868  
## [502] train-rmse:0.588726  
## [503] train-rmse:0.588609  
## [504] train-rmse:0.588591  
## [505] train-rmse:0.588418  
## [506] train-rmse:0.588328

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## [507] train-rmse:0.588265  
## [508] train-rmse:0.588231  
## [509] train-rmse:0.588106  
## [510] train-rmse:0.588044  
## [511] train-rmse:0.588023  
## [512] train-rmse:0.587864  
## [513] train-rmse:0.587687  
## [514] train-rmse:0.587539  
## [515] train-rmse:0.587459  
## [516] train-rmse:0.587313  
## [517] train-rmse:0.587254  
## [518] train-rmse:0.587225  
## [519] train-rmse:0.587136  
## [520] train-rmse:0.587119  
## [521] train-rmse:0.587070  
## [522] train-rmse:0.587044  
## [523] train-rmse:0.586971  
## [524] train-rmse:0.586920  
## [525] train-rmse:0.586819  
## [526] train-rmse:0.586772  
## [527] train-rmse:0.586733  
## [528] train-rmse:0.586653  
## [529] train-rmse:0.586593  
## [530] train-rmse:0.586445  
## [531] train-rmse:0.586379  
## [532] train-rmse:0.586277  
## [533] train-rmse:0.586124  
## [534] train-rmse:0.586047  
## [535] train-rmse:0.585934

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## [536] train-rmse:0.585871  
## [537] train-rmse:0.585794  
## [538] train-rmse:0.585743  
## [539] train-rmse:0.585650  
## [540] train-rmse:0.585566  
## [541] train-rmse:0.585511  
## [542] train-rmse:0.585489

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## [543] train rmse:0.585440  
## [544] train rmse:0.585370  
## [545] train rmse:0.585268  
## [546] train rmse:0.585248  
## [547] train rmse:0.585162  
## [548] train rmse:0.584972  
## [549] train rmse:0.584866  
## [550] train-rmse:0.584800  
## [551] train-rmse:0.584748  
## [552] train-rmse:0.584706  
## [553] train-rmse:0.584622  
## [554] train-rmse:0.584549  
## [555] train-rmse:0.584368  
## [556] train-rmse:0.584259  
## [557] train-rmse:0.584222  
## [558] train-rmse:0.584205  
## [559] train-rmse:0.584065  
## [560] train-rmse:0.583961  
## [561] train-rmse:0.583860  
## [562] train-rmse:0.583647  
## [563] train-rmse:0.583563  
## [564] train-rmse:0.583523  
## [565] train-rmse:0.583473  
## [566] train-rmse:0.583418  
## [567] train-rmse:0.583303  
## [568] train-rmse:0.583282  
## [569] train-rmse:0.583263  
## [570] train-rmse:0.583207  
## [571] train-rmse:0.583154

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## [572] train-rmse:0.583119  
## [573] train-rmse:0.583049  
## [574] train-rmse:0.582968  
## [575] train-rmse:0.582879  
## [576] train-rmse:0.582713  
## [577] train-rmse:0.582598  
## [578] train-rmse:0.582462  
## [579] train-rmse:0.582358  
## [580] train-rmse:0.582263  
## [581] train-rmse:0.582141  
## [582] train-rmse:0.582035  
## [583] train-rmse:0.581985  
## [584] train-rmse:0.581971  
## [585] train-rmse:0.581958  
## [586] train-rmse:0.581863  
## [587] train-rmse:0.581777 ## [588]  
train-rmse:0.581721 ## [589] train  
rmse:0.581668  
## [590] train rmse:0.581540  
## [591] train rmse:0.581454  
## [592] train rmse:0.581386 ## [593]  
train rmse:0.581343  
## [594] train rmse:0.581309  
## [595] train rmse:0.581255 ## [596]  
train-rmse:0.581073 ## [597] train-  
rmse:0.581055  
## [598] train-rmse:0.581052  
## [599] train-rmse:0.581045  
## [600] train-rmse:0.581031

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## [601] train-rmse:0.580923  
## [602] train-rmse:0.580849  
## [603] train-rmse:0.580817  
## [604] train-rmse:0.580691  
## [605] train-rmse:0.580619  
## [606] train-rmse:0.580599  
## [607] train-rmse:0.580584  
## [608] train-rmse:0.580485  
## [609] train-rmse:0.580383  
## [610] train-rmse:0.580271  
## [611] train-rmse:0.580135  
## [612] train-rmse:0.580098  
## [613] train-rmse:0.580032  
## [614] train-rmse:0.579964  
## [615] train-rmse:0.579837  
## [616] train-rmse:0.579730  
## [617] train-rmse:0.579687  
## [618] train-rmse:0.579640  
## [619] train-rmse:0.579564  
## [620] train-rmse:0.579511  
## [621] train-rmse:0.579368  
## [622] train-rmse:0.579225  
## [623] train-rmse:0.579206  
## [624] train-rmse:0.579200  
## [625] train-rmse:0.579157  
## [626] train-rmse:0.579129  
## [627] train-rmse:0.579061  
## [628] train-rmse:0.579016  
## [629] train-rmse:0.578932

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## [630] train-rmse:0.578838  
## [631] train-rmse:0.578712  
## [632] train-rmse:0.578629  
## [633] train-rmse:0.578587  
## [634] train-rmse:0.578571  
## [635] train-rmse:0.578491  
## [636] train-rmse:0.578471  
## [637] train-rmse:0.578391  
## [638] train-rmse:0.578329  
## [639] train-rmse:0.578225  
## [640] train rmse:0.578046  
## [641] train rmse:0.577950  
## [642] train rmse:0.577915 ## [643]  
train rmse:0.577809  
## [644] train rmse:0.577744  
## [645] train rmse:0.577566  
## [646] train rmse:0.577509  
## [647] train rmse:0.577427  
## [648] train rmse:0.577280  
## [649] train rmse:0.577161 ## [650]  
train-rmse:0.577136  
## [651] train-rmse:0.577005  
## [652] train-rmse:0.576849  
## [653] train-rmse:0.576779  
## [654] train-rmse:0.576755  
## [655] train-rmse:0.576733  
## [656] train-rmse:0.576682  
## [657] train-rmse:0.576624  
## [658] train-rmse:0.576533

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## [659] train-rmse:0.576460  
## [660] train-rmse:0.576327  
## [661] train-rmse:0.576263  
## [662] train-rmse:0.576194  
## [663] train-rmse:0.576106  
## [664] train-rmse:0.576059  
## [665] train-rmse:0.575972  
## [666] train-rmse:0.575927  
## [667] train-rmse:0.575828  
## [668] train-rmse:0.575757  
## [669] train-rmse:0.575663  
## [670] train-rmse:0.575592  
## [671] train-rmse:0.575586  
## [672] train-rmse:0.575496  
## [673] train-rmse:0.575489  
## [674] train-rmse:0.575441  
## [675] train-rmse:0.575316  
## [676] train-rmse:0.575316  
## [677] train-rmse:0.575175  
## [678] train-rmse:0.575108  
## [679] train-rmse:0.575022  
## [680] train-rmse:0.575003  
## [681] train-rmse:0.574907  
## [682] train-rmse:0.574831  
## [683] train-rmse:0.574747  
## [684] train-rmse:0.574674  
## [685] train-rmse:0.574674  
## [686] train-rmse:0.574612  
## [687] train-rmse:0.574612

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## [688] train-rmse:0.574511 ## [689]  
train-rmse:0.574402 ## [690] train  
rmse:0.574318  
## [691] train rmse:0.574233  
## [692] train rmse:0.574202

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## [693] train rmse:0.574110  
## [694] train rmse:0.574049  
## [695] train rmse:0.574033  
## [696] train rmse:0.573954  
## [697] train-rmse:0.573861  
## [698] train-rmse:0.573788  
## [699] train-rmse:0.573753  
## [700] train-rmse:0.573706  
## [701] train-rmse:0.573693  
## [702] train-rmse:0.573589  
## [703] train-rmse:0.573455  
## [704] train-rmse:0.573405  
## [705] train-rmse:0.573307  
## [706] train-rmse:0.573250  
## [707] train-rmse:0.573155  
## [708] train-rmse:0.572998  
## [709] train-rmse:0.572941  
## [710] train-rmse:0.572840  
## [711] train-rmse:0.572761  
## [712] train-rmse:0.572679  
## [713] train-rmse:0.572658  
## [714] train-rmse:0.572603  
## [715] train-rmse:0.572566  
## [716] train-rmse:0.572424  
## [717] train-rmse:0.572400  
## [718] train-rmse:0.572331  
## [719] train-rmse:0.572242  
## [720] train-rmse:0.572166

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## [721] train-rmse:0.572150  
## [722] train-rmse:0.572066  
## [723] train-rmse:0.571917  
## [724] train-rmse:0.571875  
## [725] train-rmse:0.571798  
## [726] train-rmse:0.571723  
## [727] train-rmse:0.571671  
## [728] train-rmse:0.571605  
## [729] train-rmse:0.571500  
## [730] train-rmse:0.571379  
## [731] train-rmse:0.571321  
## [732] train-rmse:0.571246  
## [733] train-rmse:0.571217  
## [734] train-rmse:0.571136  
## [735] train-rmse:0.571099  
## [736] train-rmse:0.571077  
## [737] train-rmse:0.571001  
## [738] train-rmse:0.570920  
## [739] train-rmse:0.570873  
## [740] train rmse:0.570817  
## [741] train rmse:0.570718  
## [742] train rmse:0.570566 ## [743]  
train rmse:0.570480  
## [744] train rmse:0.570408  
## [745] train rmse:0.570308  
## [746] train rmse:0.570209  
## [747] train-rmse:0.570162  
## [748] train-rmse:0.570096

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## [749] train-rmse:0.570047  
## [750] train-rmse:0.570025  
## [1] train-rmse:1.184072  
## [2] train-rmse:1.165147  
## [3] train-rmse:1.146789  
## [4] train-rmse:1.129150  
## [5] train-rmse:1.111969  
## [6] train-rmse:1.095369  
## [7] train-rmse:1.079280  
## [8] train-rmse:1.063887  
## [9] train-rmse:1.048770  
## [10] train-rmse:1.034262  
## [11] train-rmse:1.020203  
## [12] train-rmse:1.006623  
## [13] train-rmse:0.993732  
## [14] train-rmse:0.980935  
## [15] train-rmse:0.968688  
## [16] train-rmse:0.956809  
## [17] train-rmse:0.945406  
## [18] train-rmse:0.934433  
## [19] train-rmse:0.923748  
## [20] train-rmse:0.913468  
## [21] train-rmse:0.903502  
## [22] train-rmse:0.893777  
## [23] train-rmse:0.884659  
## [24] train-rmse:0.875755  
## [25] train-rmse:0.867066  
## [26] train-rmse:0.858730



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## [27] train-rmse:0.850791  
## [28] train-rmse:0.843126  
## [29] train-rmse:0.835749  
## [30] train-rmse:0.828553  
## [31] train-rmse:0.821634  
## [32] train-rmse:0.814971  
## [33] train-rmse:0.808476  
## [34] train-rmse:0.802308  
## [35] train-rmse:0.796388  
## [36] train-rmse:0.790688  
## [37] train-rmse:0.785039  
## [38] train-rmse:0.779735  
## [39] train-rmse:0.774648  
## [40] train-rmse:0.769796  
## [41] train-rmse:0.765018  
## [42] train-rmse:0.760585  
## [43] train-rmse:0.756267  
## [44] train-rmse:0.752107  
## [45] train-rmse:0.747966  
## [46] train-rmse:0.744032  
## [47] train-rmse:0.740189  
## [48] train-rmse:0.736544  
## [49] train-rmse:0.733083  
## [50] train-rmse:0.729701  
## [51] train-rmse:0.726514  
## [52] train-rmse:0.723341  
## [53] train-rmse:0.720299  
## [54] train-rmse:0.717237

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## [55] train-rmse:0.714380  
## [56] train-rmse:0.711612  
## [57] train-rmse:0.708998  
## [58] train-rmse:0.706475  
## [59] train-rmse:0.703992  
## [60] train-rmse:0.701611  
## [61] train-rmse:0.699330  
## [62] train-rmse:0.697113  
## [63] train-rmse:0.694988  
## [64] train-rmse:0.692854  
## [65] train-rmse:0.690789  
## [66] train-rmse:0.688918  
## [67] train-rmse:0.687105  
## [68] train-rmse:0.685360  
## [69] train-rmse:0.683587  
## [70] train-rmse:0.681918  
## [71] train-rmse:0.680322  
## [72] train-rmse:0.678701  
## [73] train-rmse:0.677226  
## [74] train-rmse:0.675707  
## [75] train-rmse:0.674309  
## [76] train-rmse:0.672913  
## [77] train-rmse:0.671466  
## [78] train-rmse:0.670144  
## [79] train-rmse:0.668926  
## [80] train-rmse:0.667572  
## [81] train-rmse:0.666304  
## [82] train-rmse:0.665198

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## [83] train-rmse:0.664021  
## [84] train-rmse:0.662811  
## [85] train-rmse:0.661638  
## [86] train-rmse:0.660670  
## [87] train-rmse:0.659674  
## [88] train-rmse:0.658753  
## [89] train-rmse:0.657724  
## [90] train-rmse:0.656791  
## [91] train-rmse:0.655910  
## [92] train-rmse:0.654953

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## [93] train-rmse:0.654085
## [94] train-rmse:0.653205
## [95] train-rmse:0.652302
## [96] train-rmse:0.651521
## [97] train-rmse:0.650837
## [98] train-rmse:0.650129
## [99] train-rmse:0.649419
## [100] train-rmse:0.648697
## [101] train-rmse:0.648034
## [102] train-rmse:0.647422
## [103] train-rmse:0.646711
## [104] train-rmse:0.646070
## [105] train-rmse:0.645452
## [106] train-rmse:0.644826
## [107] train-rmse:0.644175
## [108] train-rmse:0.643497
## [109] train-rmse:0.642925
## [110] train-rmse:0.642344
## [111] train-rmse:0.641792
## [112] train-rmse:0.641171
## [113] train-rmse:0.640596
## [114] train-rmse:0.639920
## [115] train-rmse:0.639357
## [116] train-rmse:0.638907
## [117] train-rmse:0.638398
## [118] train-rmse:0.637835
## [119] train-rmse:0.637456
## [120] train-rmse:0.636969
## [121] train-rmse:0.636536
## [122] train-rmse:0.635917
## [123] train-rmse:0.635395
## [124] train-rmse:0.635051
## [125] train-rmse:0.634661
## [126] train-rmse:0.634274
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## [127] train-rmse:0.633818  
## [128] train-rmse:0.633393  
## [129] train-rmse:0.633026  
## [130] train-rmse:0.632576  
## [131] train-rmse:0.632095  
## [132] train-rmse:0.631668  
## [133] train-rmse:0.631259  
## [134] train-rmse:0.630834  
## [135] train-rmse:0.630418  
## [136] train-rmse:0.630069 ## [137]  
train-rmse:0.629570 ## [138] train-  
rmse:0.629214  
## [139] train rmse:0.628817  
## [140] train rmse:0.628503  
## [141] train rmse:0.628166  
## [142] train rmse:0.627859 ## [143]  
train rmse:0.627515  
## [144] train rmse:0.627210 ## [145]  
train-rmse:0.626928 ## [146] train-  
rmse:0.626598  
## [147] train-rmse:0.626266  
## [148] train-rmse:0.626038  
## [149] train-rmse:0.625755  
## [150] train-rmse:0.625423  
## [151] train-rmse:0.625059  
## [152] train-rmse:0.624809  
## [153] train-rmse:0.624482  
## [154] train-rmse:0.624151

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## [155] train-rmse:0.623954  
## [156] train-rmse:0.623601  
## [157] train-rmse:0.623319  
## [158] train-rmse:0.623003  
## [159] train-rmse:0.622701  
## [160] train-rmse:0.622355  
## [161] train-rmse:0.622163  
## [162] train-rmse:0.621853  
## [163] train-rmse:0.621590  
## [164] train-rmse:0.621346  
## [165] train-rmse:0.621058  
## [166] train-rmse:0.620827  
## [167] train-rmse:0.620609  
## [168] train-rmse:0.620431  
## [169] train-rmse:0.620171  
## [170] train-rmse:0.619838  
## [171] train-rmse:0.619540  
## [172] train-rmse:0.619208  
## [173] train-rmse:0.618900  
## [174] train-rmse:0.618632  
## [175] train-rmse:0.618407  
## [176] train-rmse:0.618230  
## [177] train-rmse:0.617958  
## [178] train-rmse:0.617774  
## [179] train-rmse:0.617546  
## [180] train-rmse:0.617385  
## [181] train-rmse:0.617137  
## [182] train-rmse:0.616811

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## [183] train-rmse:0.616578  
## [184] train-rmse:0.616358  
## [185] train-rmse:0.616157  
## [186] train rmse:0.615912  
## [187] train rmse:0.615620  
## [188] train rmse:0.615402  
## [189] train rmse:0.615282  
## [190] train rmse:0.615181  
## [191] train rmse:0.614824  
## [192] train rmse:0.614664 ## [193]  
train rmse:0.614381  
## [194] train rmse:0.614224  
## [195] train rmse:0.613905  
## [196] train-rmse:0.613611  
## [197] train-rmse:0.613445  
## [198] train-rmse:0.613186 ## [199]  
train-rmse:0.612988 ## [200] train-  
rmse:0.612757  
## [201] train-rmse:0.612492  
## [202] train-rmse:0.612380  
## [203] train-rmse:0.612219  
## [204] train-rmse:0.612065  
## [205] train-rmse:0.611934  
## [206] train-rmse:0.611858  
## [207] train-rmse:0.611673  
## [208] train-rmse:0.611500  
## [209] train-rmse:0.611268  
## [210] train-rmse:0.611154

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## [211] train-rmse:0.610987  
## [212] train-rmse:0.610774  
## [213] train-rmse:0.610560  
## [214] train-rmse:0.610352  
## [215] train-rmse:0.610130  
## [216] train-rmse:0.610012  
## [217] train-rmse:0.609821  
## [218] train-rmse:0.609694  
## [219] train-rmse:0.609450  
## [220] train-rmse:0.609277  
## [221] train-rmse:0.609171  
## [222] train-rmse:0.609044  
## [223] train-rmse:0.608782  
## [224] train-rmse:0.608600  
## [225] train-rmse:0.608334  
## [226] train-rmse:0.608170  
## [227] train-rmse:0.608069  
## [228] train-rmse:0.607838  
## [229] train-rmse:0.607693  
## [230] train-rmse:0.607575  
## [231] train-rmse:0.607357  
## [232] train-rmse:0.607261  
## [233] train-rmse:0.607095  
## [234] train-rmse:0.606992  
## [235] train-rmse:0.606883  
## [236] train-rmse:0.606637

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## [237] train-rmse:0.606559 ## [238]  
train-rmse:0.606432 ## [239] train  
rmse:0.606372  
## [240] train rmse:0.606206  
## [241] train rmse:0.606024  
## [242] train rmse:0.605942

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## [243] train rmse:0.605747  
## [244] train rmse:0.605579  
## [245] train rmse:0.605422  
## [246] train-rmse:0.605309  
## [247] train-rmse:0.605088  
## [248] train-rmse:0.604901  
## [249] train-rmse:0.604806  
## [250] train-rmse:0.604753  
## [251] train-rmse:0.604629  
## [252] train-rmse:0.604507  
## [253] train-rmse:0.604388  
## [254] train-rmse:0.604206  
## [255] train-rmse:0.603971  
## [256] train-rmse:0.603876  
## [257] train-rmse:0.603751  
## [258] train-rmse:0.603596  
## [259] train-rmse:0.603496  
## [260] train-rmse:0.603430  
## [261] train-rmse:0.603321  
## [262] train-rmse:0.603246  
## [263] train-rmse:0.603100  
## [264] train-rmse:0.602898  
## [265] train-rmse:0.602867  
## [266] train-rmse:0.602765  
## [267] train-rmse:0.602697  
## [268] train-rmse:0.602563  
## [269] train-rmse:0.602514  
## [270] train-rmse:0.602373

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## [271] train-rmse:0.602200  
## [272] train-rmse:0.602085  
## [273] train-rmse:0.602031  
## [274] train-rmse:0.601891  
## [275] train-rmse:0.601762  
## [276] train-rmse:0.601660  
## [277] train-rmse:0.601553  
## [278] train-rmse:0.601399  
## [279] train-rmse:0.601260  
## [280] train-rmse:0.601018  
## [281] train-rmse:0.600854  
## [282] train-rmse:0.600782  
## [283] train-rmse:0.600745  
## [284] train-rmse:0.600537  
## [285] train-rmse:0.600476  
## [286] train rmse:0.600284  
## [287] train rmse:0.600155  
## [288] train rmse:0.599981  
## [289] train rmse:0.599803  
## [290] train rmse:0.599541  
## [291] train rmse:0.599408  
## [292] train rmse:0.599289 ## [293]  
train rmse:0.599221  
## [294] train rmse:0.599126  
## [295] train rmse:0.599025  
## [296] train-rmse:0.598899  
## [297] train-rmse:0.598729  
## [298] train-rmse:0.598660

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## [299] train-rmse:0.598554 ## [300]  
train-rmse:0.598405

## [301] train-rmse:0.598405  
## [302] train-rmse:0.598365  
## [303] train-rmse:0.598249  
## [304] train-rmse:0.598111  
## [305] train-rmse:0.598032  
## [306] train-rmse:0.597858  
## [307] train-rmse:0.597804  
## [308] train-rmse:0.597700  
## [309] train-rmse:0.597547  
## [310] train-rmse:0.597411  
## [311] train-rmse:0.597273  
## [312] train-rmse:0.597124  
## [313] train-rmse:0.596849  
## [314] train-rmse:0.596782  
## [315] train-rmse:0.596645  
## [316] train-rmse:0.596440  
## [317] train-rmse:0.596354  
## [318] train-rmse:0.596209  
## [319] train-rmse:0.596180  
## [320] train-rmse:0.596113  
## [321] train-rmse:0.596054  
## [322] train-rmse:0.595936  
## [323] train-rmse:0.595799  
## [324] train-rmse:0.595643  
## [325] train-rmse:0.595572  
## [326] train-rmse:0.595489

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## [327] train-rmse:0.595325  
## [328] train-rmse:0.595273  
## [329] train-rmse:0.595142  
## [330] train-rmse:0.595031  
## [331] train-rmse:0.594909  
## [332] train-rmse:0.594772  
## [333] train-rmse:0.594725  
## [334] train-rmse:0.594554  
## [335] train-rmse:0.594366  
## [336] train-rmse:0.594178  
## [337] train-rmse:0.594008  
## [338] train-rmse:0.593964 ## [339]  
train-rmse:0.593909 ## [340] train  
rmse:0.593862  
## [341] train rmse:0.593830  
## [342] train rmse:0.593796 ## [343]  
train rmse:0.593675  
## [344] train rmse:0.593607  
## [345] train rmse:0.593535  
## [346] train rmse:0.593449  
## [347] train-rmse:0.593340  
## [348] train-rmse:0.593217  
## [349] train-rmse:0.593001  
## [350] train-rmse:0.592929  
## [351] train-rmse:0.592742  
## [352] train-rmse:0.592629  
## [353] train-rmse:0.592593  
## [354] train-rmse:0.592473

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## [355] train-rmse:0.592405  
## [356] train-rmse:0.592314  
## [357] train-rmse:0.592165  
## [358] train-rmse:0.591930  
## [359] train-rmse:0.591837  
## [360] train-rmse:0.591798  
## [361] train-rmse:0.591639  
## [362] train-rmse:0.591600  
## [363] train-rmse:0.591520  
## [364] train-rmse:0.591396  
## [365] train-rmse:0.591310  
## [366] train-rmse:0.591148  
## [367] train-rmse:0.591059  
## [368] train-rmse:0.590955  
## [369] train-rmse:0.590840  
## [370] train-rmse:0.590805  
## [371] train-rmse:0.590720  
## [372] train-rmse:0.590602  
## [373] train-rmse:0.590516  
## [374] train-rmse:0.590436  
## [375] train-rmse:0.590332  
## [376] train-rmse:0.590122  
## [377] train-rmse:0.590063  
## [378] train-rmse:0.589870  
## [379] train-rmse:0.589763  
## [380] train-rmse:0.589662  
## [381] train-rmse:0.589519  
## [382] train-rmse:0.589354

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## [383] train-rmse:0.589267  
## [384] train-rmse:0.589083  
## [385] train-rmse:0.589028  
## [386] train rmse:0.588930  
## [387] train rmse:0.588855  
## [388] train rmse:0.588780  
## [389] train rmse:0.588649  
## [390] train rmse:0.588514  
## [391] train rmse:0.588426  
## [392] train rmse:0.588219

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## [393]   train-rmse:0.588164 ## [394]
train-rmse:0.588128
## [395]   train-rmse:0.587949
## [396]   train-rmse:0.587883
## [397]   train-rmse:0.587827
## [398]   train-rmse:0.587739
## [399]   train-rmse:0.587563
## [400]   train-rmse:0.587481
## [401]   train-rmse:0.587421
## [402]   train-rmse:0.587345
## [403]   train-rmse:0.587282
## [404]   train-rmse:0.587203
## [405]   train-rmse:0.587045
## [406]   train-rmse:0.587008
## [407]   train-rmse:0.586961
## [408]   train-rmse:0.586816
## [409]   train-rmse:0.586579
## [410]   train-rmse:0.586482
## [411]   train-rmse:0.586426
## [412]   train-rmse:0.586327
## [413]   train-rmse:0.586234
## [414]   train-rmse:0.586122
## [415]   train-rmse:0.586111
## [416]   train-rmse:0.586037
## [417]   train-rmse:0.585954
## [418]   train-rmse:0.585906
## [419]   train-rmse:0.585874
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## [420] train-rmse:0.585799
## [421] train-rmse:0.585618
## [422] train-rmse:0.585572
## [423] train-rmse:0.585473
## [424] train-rmse:0.585373
## [425] train-rmse:0.585270
## [426] train-rmse:0.585166
## [427] train-rmse:0.585061
## [428] train-rmse:0.585026
## [429] train-rmse:0.585000
## [430] train-rmse:0.584934
## [431] train-rmse:0.584781
## [432] train-rmse:0.584653
## [433] train-rmse:0.584641
## [434] train-rmse:0.584589
## [435] train-rmse:0.584464
## [436] train-rmse:0.584393
## [437] train-rmse:0.584243
## [438] train-rmse:0.584149
## [439] train-rmse:0.584028
## [440] train-rmse:0.583922
## [441] train rmse:0.583804
## [442] train rmse:0.583601 ## [443]
train rmse:0.583494
## [444] train rmse:0.583454
## [445] train rmse:0.583443
## [446] train rmse:0.583416
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## [447] train rmse:0.583292  
## [448] train rmse:0.583239  
## [449] train-rmse:0.583120  
## [450] train-rmse:0.582975  
## [451] train-rmse:0.582841  
## [452] train-rmse:0.582789  
## [453] train-rmse:0.582619  
## [454] train-rmse:0.582526  
## [455] train-rmse:0.582411  
## [456] train-rmse:0.582278  
## [457] train-rmse:0.582165  
## [458] train-rmse:0.582052  
## [459] train-rmse:0.581963  
## [460] train-rmse:0.581954  
## [461] train-rmse:0.581851  
## [462] train-rmse:0.581747  
## [463] train-rmse:0.581741  
## [464] train-rmse:0.581565  
## [465] train-rmse:0.581474  
## [466] train-rmse:0.581447  
## [467] train-rmse:0.581355  
## [468] train-rmse:0.581218  
## [469] train-rmse:0.581099  
## [470] train-rmse:0.581017  
## [471] train-rmse:0.580888  
## [472] train-rmse:0.580848  
## [473] train-rmse:0.580750

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## [474] train-rmse:0.580595
## [475] train-rmse:0.580499
## [476] train-rmse:0.580438
## [477] train-rmse:0.580322
## [478] train-rmse:0.580213
## [479] train-rmse:0.580176
## [480] train-rmse:0.580052
## [481] train-rmse:0.580036
## [482] train-rmse:0.579990
## [483] train-rmse:0.579972
## [484] train-rmse:0.579868
## [485] train-rmse:0.579798
## [486] train rmse:0.579718
## [487] train rmse:0.579673
## [488] train rmse:0.579603
## [489] train rmse:0.579504
## [490] train rmse:0.579486
## [491] train rmse:0.579438
## [492] train rmse:0.579373 ## [493]
train rmse:0.579275 ## [494] train-
rmse:0.579227 ## [495] train-
rmse:0.579151
## [496] train-rmse:0.579114
## [497] train-rmse:0.579099
## [498] train-rmse:0.579027
## [499] train-rmse:0.578975
## [500] train-rmse:0.578947
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## [501] train-rmse:0.578848  
## [502] train-rmse:0.578778  
## [503] train-rmse:0.578755  
## [504] train-rmse:0.578650  
## [505] train-rmse:0.578578  
## [506] train-rmse:0.578430  
## [507] train-rmse:0.578324  
## [508] train-rmse:0.578285  
## [509] train-rmse:0.578186  
## [510] train-rmse:0.578052  
## [511] train-rmse:0.577937  
## [512] train-rmse:0.577881  
## [513] train-rmse:0.577849  
## [514] train-rmse:0.577830  
## [515] train-rmse:0.577703  
## [516] train-rmse:0.577632  
## [517] train-rmse:0.577459  
## [518] train-rmse:0.577438  
## [519] train-rmse:0.577355  
## [520] train-rmse:0.577316  
## [521] train-rmse:0.577198  
## [522] train-rmse:0.577135  
## [523] train-rmse:0.577031  
## [524] train-rmse:0.577000  
## [525] train-rmse:0.576863  
## [526] train-rmse:0.576813  
## [527] train-rmse:0.576676

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## [528] train-rmse:0.576642  
## [529] train-rmse:0.576607  
## [530] train-rmse:0.576587  
## [531] train-rmse:0.576444  
## [532] train-rmse:0.576405  
## [533] train-rmse:0.576353  
## [534] train-rmse:0.576258  
## [535] train-rmse:0.576197  
## [536] train-rmse:0.576025  
## [537] train-rmse:0.576015  
## [538] train-rmse:0.575987  
## [539] train-rmse:0.575932  
## [540] train-rmse:0.575890  
## [541] train-rmse:0.575828  
## [542] train rmse:0.575828

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## [543] train rmse:0.575700  
## [544] train rmse:0.575552  
## [545] train rmse:0.575466  
## [546] train rmse:0.575452  
## [547] train rmse:0.575407  
## [548] train rmse:0.575345  
## [549] train-rmse:0.575288  
## [550] train-rmse:0.575214  
## [551] train-rmse:0.575118  
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## [554] train-rmse:0.574852  
## [555] train-rmse:0.574727  
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## [558] train-rmse:0.574534  
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## [562] train-rmse:0.574199  
## [563] train-rmse:0.574078  
## [564] train-rmse:0.573973  
## [565] train-rmse:0.573828  
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## [567] train-rmse:0.573755  
## [568] train-rmse:0.573701  
## [569] train-rmse:0.573662  
## [570] train-rmse:0.573578

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## [571] train-rmse:0.573510  
## [572] train-rmse:0.573482  
## [573] train-rmse:0.573453  
## [574] train-rmse:0.573415  
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## [576] train-rmse:0.573251  
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## [581] train-rmse:0.572892  
## [582] train-rmse:0.572825  
## [583] train-rmse:0.572714  
## [584] train-rmse:0.572636  
## [585] train-rmse:0.572551  
## [586] train-rmse:0.572476 ## [587]  
train-rmse:0.572314 ## [588] train  
rmse:0.572216  
## [589] train rmse:0.572173  
## [590] train rmse:0.572110  
## [591] train rmse:0.572070  
## [592] train rmse:0.571984 ## [593]  
train rmse:0.571900  
## [594] train rmse:0.571890 ## [595]  
train-rmse:0.571814 ## [596] train-  
rmse:0.571717  
## [597] train-rmse:0.571675

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## [598] train-rmse:0.571629  
## [599] train-rmse:0.571510  
## [600] train-rmse:0.571363  
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## [604] train-rmse:0.571051  
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## [609] train-rmse:0.570753  
## [610] train-rmse:0.570715  
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## [616] train-rmse:0.570204  
## [617] train-rmse:0.570146  
## [618] train-rmse:0.570102  
## [619] train-rmse:0.570076  
## [620] train-rmse:0.569997  
## [621] train-rmse:0.569940  
## [622] train-rmse:0.569937  
## [623] train-rmse:0.569832  
## [624] train-rmse:0.569770

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## [625] train-rmse:0.569722  
## [626] train-rmse:0.569611  
## [627] train-rmse:0.569571  
## [628] train-rmse:0.569525  
## [629] train-rmse:0.569469  
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## [631] train-rmse:0.569273  
## [632] train-rmse:0.569199  
## [633] train-rmse:0.569161  
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## [635] train-rmse:0.569080  
## [636] train-rmse:0.568958  
## [637] train-rmse:0.568838  
## [638] train-rmse:0.568744  
## [639] train rmse:0.568696  
## [640] train rmse:0.568593  
## [641] train rmse:0.568512  
## [642] train rmse:0.568433 ## [643]  
train rmse:0.568418  
## [644] train rmse:0.568412  
## [645] train rmse:0.568349  
## [646] train rmse:0.568301  
## [647] train rmse:0.568238  
## [648] train rmse:0.568168 ## [649]  
train-rmse:0.568100 ## [650] train-  
rmse:0.567967  
## [651] train-rmse:0.567810

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## [652] train-rmse:0.567733  
## [653] train-rmse:0.567622  
## [654] train-rmse:0.567587  
## [655] train-rmse:0.567543  
## [656] train-rmse:0.567436  
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## [663] train-rmse:0.566911  
## [664] train-rmse:0.566822  
## [665] train-rmse:0.566759  
## [666] train-rmse:0.566711  
## [667] train-rmse:0.566646  
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## [675] train-rmse:0.566230  
## [676] train-rmse:0.566126  
## [677] train-rmse:0.566054  
## [678] train-rmse:0.566010

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## [679] train-rmse:0.565874  
## [680] train-rmse:0.565812  
## [681] train-rmse:0.565755  
## [682] train-rmse:0.565715  
## [683] train-rmse:0.565651  
## [684] train-rmse:0.565637  
## [685] train-rmse:0.565482  
## [686] train-rmse:0.565442  
## [687] train-rmse:0.565429 ## [688]  
train-rmse:0.565388 ## [689] train  
rmse:0.565270  
## [690] train rmse:0.565209  
## [691] train rmse:0.565160  
## [692] train rmse:0.565064

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## [693] train rmse:0.565028  
## [694] train rmse:0.564922  
## [695] train rmse:0.564890  
## [696] train-rmse:0.564833  
## [697] train-rmse:0.564769  
## [698] train-rmse:0.564721  
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## [702] train-rmse:0.564495  
## [703] train-rmse:0.564447  
## [704] train-rmse:0.564421  
## [705] train-rmse:0.564350  
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## [710] train-rmse:0.564094  
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## [714] train-rmse:0.563948  
## [715] train-rmse:0.563918  
## [716] train-rmse:0.563885  
## [717] train-rmse:0.563860  
## [718] train-rmse:0.563777  
## [719] train-rmse:0.563762  
## [720] train-rmse:0.563702

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-

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## [721] train-rmse:0.563575
## [722] train-rmse:0.563509
## [723] train-rmse:0.563446
## [724] train-rmse:0.563326
## [725] train-rmse:0.563325
## [726] train-rmse:0.563301
## [727] train-rmse:0.563282
## [728] train-rmse:0.563237
## [729] train-rmse:0.563123
## [730] train-rmse:0.563030
## [731] train-rmse:0.562968
## [732] train-rmse:0.562924
## [733] train-rmse:0.562902
## [734] train-rmse:0.562880
## [735] train-rmse:0.562843
## [736] train-rmse:0.562843
## [737] train-rmse:0.562831
## [738] train-rmse:0.562796
## [739] train rmse:0.562747
## [740] train rmse:0.562686
## [741] train rmse:0.562656
## [742] train rmse:0.562643 ## [743] train rmse:0.562534
## [744] train rmse:0.562509
## [745] train rmse:0.562502
## [746] train-rmse:0.562473
## [747] train-rmse:0.562455
## [748] train-rmse:0.562373
## [749] train-rmse:0.562366
## [750] train-rmse:0.562289

```

#### *# combine meta features*

```

sg_col = c("meta_knn", "meta_glm", "meta_svm", "meta_rf", "meta_xgb", "y") train_sg = data.frame(
  meta_knn_train, meta_glm_train, meta_svm_train, meta_rf
  _train, meta_xgb_train, train_y)
test_sg = data.frame(meta_knn_test, meta_glm_test, meta_svm_test, meta_rf_test, meta_xgb_test,
  test_y) colnames(train_sg) = sg_col colnames(test_sg) = sg_col

```

```

# ensemble with elastic-net regression train_sg_sparse = model.matrix(y ~ . - 1, data = train_sg, sparse
= T) test_sg_sparse = model.matrix(y ~ . - 1, data = test_sg, sparse = T) mdl_glm =
cv.glmnet(train_sg_sparse, train_y, family = "gaussian", alpha = 0.
2)
pred_glm = predict(mdl_glm, newx = test_sg_sparse, s = "lambda.min") mse(pred_glm, test_y)

```

train- train- train- train- train- train- train-

```
## [1] 0.3840147
```

```
library(data.table)
```

```
library(foreach)
```

```
library(MatrixModels)
```

```
library(xgboost)
```

```
library(ranger)
```

```
# load and combine dataset train =
```

```
fread("BlogFeedback-Train.csv") test =
```

```
fread("BlogFeedback-Test.csv")
```

```
# error measure mse = function(y_hat, y) { mse = mean((y - y_hat)^2)  
return(mse)}
```

train- train- train- train- train- train- train- train-

```

# create
design
matrices

train_x = model.Matrix(V281 ~ . - 1, data = train, sparse = F)

train_y =
train$V281

test_x = model.Matrix(V281 ~ . - 1, data = test, sparse = F)

test_y =
test$V281

train_xgb = xgb.DMatrix(data = as.matrix(train_x), label = train_y) test_xgb =
xgb.DMatrix(data = as.matrix(test_x), label = test_y)

# number of
models n = 5

# fit XGBoost
pred_xgb = foreach(i = 1:n, .combine = cbind) %do% { mdl_xgb = xgboost(data
train_xgb, nround = 750, nthread = 4, max_depth = 6, eta = 0.025, subsample
=
= 0.7, gamma
= 3)

return(predict(mdl_xgb, test_xgb))}

# fit random
forest

pred_rf = foreach(i = 1:n, .combine = cbind) %do% { mdl_rf = ranger(V281 ~ ., data =
train, num.trees = 1000, mtry = 120, write.forest = T) return(predict(mdl_rf,
test)$predictions)}

mse(rowMeans(pred_rf) * 0.25 + rowMeans(pred_xgb) * 0.75, test_y)

# weighted
average

```

```

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|=====|
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|=====|
[1]          rmse:1.123122

```

train- train- train- train- train- train- train- train-

[2]	rmse:1.105641
[3]	rmse:1.088758
[4]	rmse:1.072427
[5]	rmse:1.056559
[6]	rmse:1.041096
[7]	rmse:1.026287
[8]	rmse:1.011939

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train- train- train- train- train- train- train-

[9]	rmse:0.998131
[10]	rmse:0.984787
[11]	rmse:0.971762
[12]	rmse:0.959325
[13]	rmse:0.947338
[14]	rmse:0.935682
[15]	rmse:0.924345
[16]	train-rmse:0.913451
[17]	train-rmse:0.903073
[18]	train-rmse:0.893087
[19]	train-rmse:0.883354
[20]	train-rmse:0.873861
[21]	train-rmse:0.864709
[22]	train-rmse:0.856002
[23]	train-rmse:0.847568
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[25]	train-rmse:0.831521
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[27]	train-rmse:0.816727
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[29]	train-rmse:0.803047
[30]	train-rmse:0.796569
[31]	train-rmse:0.790335
[32]	train-rmse:0.784175
[33]	train-rmse:0.778386
[34]	train-rmse:0.772695
[35]	train-rmse:0.767116
[36]	train-rmse:0.761938
[37]	train-rmse:0.756940
[38]	train-rmse:0.752111
[39]	train-rmse:0.747458
[40]	train-rmse:0.742959
[41]	train-rmse:0.738648
[42]	train-rmse:0.734499
[43]	train-rmse:0.730367
[44]	train-rmse:0.726442
[45]	train-rmse:0.722791
[46]	train-rmse:0.719198
[47]	train-rmse:0.715713
[48]	train-rmse:0.712466
[49]	train-rmse:0.709212

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	train-	train-	train-	train-	train-
[50]		train-rmse:0.706178			
[51]		train-rmse:0.703222			
[52]		train-rmse:0.700330			
[53]		train-rmse:0.697545			
[54]		train-rmse:0.694790			
[55]		rmse:0.692126			
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[57]		rmse:0.687291			
[58]		rmse:0.684980			
[59]		rmse:0.682716			
[60]		rmse:0.680483			
[61]		rmse:0.678363			
[62]		rmse:0.676362			
[63]		rmse:0.674384			
[64]		rmse:0.672429			
[65]		rmse:0.670621			
[66]		rmse:0.668763			
[67]	train-rmse:0.667090				
[68]	train-rmse:0.665487				
[69]	train-rmse:0.663911				
[70]	train-rmse:0.662479				
[71]	train-rmse:0.660946				
[72]	train-rmse:0.659443				
[73]	train-rmse:0.658089				
[74]	train-rmse:0.656753				
[75]	train-rmse:0.655411				
[76]	train-rmse:0.654126				
[77]	train-rmse:0.652865				
[78]	train-rmse:0.651686				
[79]	train-rmse:0.650529				
[80]	train-rmse:0.649422				
[81]	train-rmse:0.648356				
[82]	train-rmse:0.647258				
[83]	train-rmse:0.646194				
[84]	train-rmse:0.645248				
[85]	train-rmse:0.644273				
[86]	train-rmse:0.643318				
[87]	train-rmse:0.642332				
[88]	train-rmse:0.641385				
[89]	train-rmse:0.640558				

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	train-	train-	train-	train-	train-
[168]	train-rmse:0.606817				
[169]	train-rmse:0.606554				
[170]	train-rmse:0.606284				
[171]	train-rmse:0.606046				
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[173]	train-rmse:0.605614				
[174]	train-rmse:0.605338				
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[177]	train-rmse:0.604671				
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[181]	train-rmse:0.603841				
[182]	train-rmse:0.603701				
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[184]	train-rmse:0.603362				
[185]	train-rmse:0.603162				
[186]	train-rmse:0.602937				
[187]	train-rmse:0.602790				
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[204]	rmse:0.599649				
[205]	rmse:0.599432				
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train- [207]	train- [208]	train- [209]	train- [210]	train- [211]	train- [212]	train- [213]	train- [214]
			rmse:0.599043				
			rmse:0.598775				

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train- train-

[209] rmse:0.598542  
[210] rmse:0.598379  
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[213] train-rmse:0.597780  
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[240] train-rmse:0.593999  
[241] train-rmse:0.593827  
[242] train-rmse:0.593739

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train-	train-	train-	train-	train-	train-	train-	train-
[409]			rmse:0.576594				
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[444]	train-rmse:	0.573457					

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train-	train-	train-	train-	train-	train-	train-	train-
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[479]	train-rmse:0.570448						
[480]	train-rmse:0.570392						

train- train- train-

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[481]	train-rmse:0.570343						
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[514]	train-rmse:0.568352						
[515]	train-rmse:0.568230						
[516]	train-rmse:0.568077						

train- train- train-

train-	train-	train-	train-	train-	train-	train-	train-
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Growing trees.. Progress: 1%. Estimated remaining time: 48 minutes, 5 seconds.

Growing trees.. Progress: 3%. Estimated remaining time: 42 minutes, 2 seconds.

Growing trees.. Progress: 4%. Estimated remaining time: 41 minutes, 42 seconds.

Growing trees.. Progress: 6%. Estimated remaining time: 39 minutes, 48

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Growing trees.. Progress: 7%. Estimated remaining time: 39 minutes, 17 seconds.  
Growing trees.. Progress: 8%. Estimated remaining time: 38 minutes, 45 seconds.  
Growing trees.. Progress: 10%. Estimated remaining time: 38 minutes, 8 seconds.  
Growing trees.. Progress: 11%. Estimated remaining time: 36 minutes, 42 seconds.  
Growing trees.. Progress: 12%. Estimated remaining time: 36 minutes, 44 seconds.  
Growing trees.. Progress: 14%. Estimated remaining time: 35 minutes, 30 seconds.  
Growing trees.. Progress: 15%. Estimated remaining time: 35 minutes, 25 seconds.  
Growing trees.. Progress: 17%. Estimated remaining time: 34 minutes, 25 seconds.  
Growing trees.. Progress: 18%. Estimated remaining time: 34 minutes, 5 seconds.  
Growing trees.. Progress: 19%. Estimated remaining time: 33 minutes, 18 seconds.  
Growing trees.. Progress: 21%. Estimated remaining time: 32 minutes, 48 seconds.  
Growing trees.. Progress: 22%. Estimated remaining time: 32 minutes, 18 seconds.  
Growing trees.. Progress: 24%. Estimated remaining time: 31 minutes, 31 seconds.  
Growing trees.. Progress: 25%. Estimated remaining time: 31 minutes, 4 seconds.  
Growing trees.. Progress: 26%. Estimated remaining time: 30 minutes, 37 seconds.  
Growing trees.. Progress: 28%. Estimated remaining time: 29 minutes, 55 seconds.  
Growing trees.. Progress: 29%. Estimated remaining time: 29 minutes, 22 seconds.  
Growing trees.. Progress: 30%. Estimated remaining time: 29 minutes, 0 seconds.  
Growing trees.. Progress: 31%. Estimated remaining time: 28 minutes, 32 seconds.  
Growing trees.. Progress: 33%. Estimated remaining time: 28 minutes, 4 seconds.  
Growing trees.. Progress: 34%. Estimated remaining time: 27 minutes, 25 seconds.  
Growing trees.. Progress: 35%. Estimated remaining time: 26 minutes, 58 seconds.  
Growing trees.. Progress: 37%. Estimated remaining time: 26 minutes, 18 seconds.  
Growing trees.. Progress: 38%. Estimated remaining time: 25 minutes, 50 seconds.  
Growing trees.. Progress: 39%. Estimated remaining time: 25 minutes, 18 Growing trees.. Progress: 41%.  
Estimated remaining time: 24 minutes, 45 seconds.  
Growing trees.. Progress: 42%. Estimated remaining time: 24 minutes, 11 seconds.  
Growing trees.. Progress: 43%. Estimated remaining time: 23 minutes, 41 seconds.  
Growing trees.. Progress: 45%. Estimated remaining time: 23 minutes, 1 seconds.  
Growing trees.. Progress: 46%. Estimated remaining time: 22 minutes, 33 seconds.  
Growing trees.. Progress: 47%. Estimated remaining time: 21 minutes, 58 seconds.  
Growing trees.. Progress: 49%. Estimated remaining time: 21 minutes, 25 seconds.  
Growing trees.. Progress: 50%. Estimated remaining time: 20 minutes, 53 seconds.  
Growing trees.. Progress: 51%. Estimated remaining time: 20 minutes, 16 seconds.  
Growing trees.. Progress: 53%. Estimated remaining time: 19 minutes, 44 seconds.  
Growing trees.. Progress: 54%. Estimated remaining time: 19 minutes, 12 seconds.  
Growing trees.. Progress: 55%. Estimated remaining time: 18 minutes, 34 seconds.  
Growing trees.. Progress: 57%. Estimated remaining time: 18 minutes, 5 seconds.  
Growing trees.. Progress: 58%. Estimated remaining time: 17 minutes, 35 seconds.  
Growing trees.. Progress: 59%. Estimated remaining time: 16 minutes, 55 seconds.  
seconds.

Growing trees.. Progress: 61%. Estimated remaining time: 16 minutes, 13 seconds.  
Growing trees.. Progress: 62%. Estimated remaining time: 15 minutes, 43 seconds.  
Growing trees.. Progress: 64%. Estimated remaining time: 15 minutes, 4 seconds.  
Growing trees.. Progress: 65%. Estimated remaining time: 14 minutes, 33 seconds.  
Growing trees.. Progress: 66%. Estimated remaining time: 13 minutes, 56 seconds.  
Growing trees.. Progress: 68%. Estimated remaining time: 13 minutes, 25 seconds.  
Growing trees.. Progress: 69%. Estimated remaining time: 12 minutes, 57 seconds.  
Growing trees.. Progress: 70%. Estimated remaining time: 12 minutes, 18 seconds.  
Growing trees.. Progress: 72%. Estimated remaining time: 11 minutes, 47 seconds.  
Growing trees.. Progress: 73%. Estimated remaining time: 11 minutes, 10 Growing trees.. Progress: 74%.  
Estimated remaining time: 10 minutes, 38 seconds.  
Growing trees.. Progress: 76%. Estimated remaining time: 10 minutes, 7 seconds.  
Growing trees.. Progress: 77%. Estimated remaining time: 9 minutes, 31 seconds.  
Growing trees.. Progress: 78%. Estimated remaining time: 8 minutes, 58 seconds.  
Growing trees.. Progress: 80%. Estimated remaining time: 8 minutes, 26 seconds.  
Growing trees.. Progress: 81%. Estimated remaining time: 7 minutes, 57 seconds.  
Growing trees.. Progress: 82%. Estimated remaining time: 7 minutes, 21 seconds.  
Growing trees.. Progress: 84%. Estimated remaining time: 6 minutes, 49 seconds.  
Growing trees.. Progress: 85%. Estimated remaining time: 6 minutes, 17 seconds.  
Growing trees.. Progress: 86%. Estimated remaining time: 5 minutes, 44 seconds.  
Growing trees.. Progress: 88%. Estimated remaining time: 5 minutes, 11 seconds.  
Growing trees.. Progress: 89%. Estimated remaining time: 4 minutes, 39 seconds.  
Growing trees.. Progress: 90%. Estimated remaining time: 4 minutes, 7 seconds.  
Growing trees.. Progress: 92%. Estimated remaining time: 3 minutes, 31 seconds.  
Growing trees.. Progress: 93%. Estimated remaining time: 2 minutes, 59 seconds.  
Growing trees.. Progress: 94%. Estimated remaining time: 2 minutes, 30 seconds.  
Growing trees.. Progress: 95%. Estimated remaining time: 1 minute, 57 seconds.  
Growing trees.. Progress: 97%. Estimated remaining time: 1 minute, 25 seconds.  
Growing trees.. Progress: 98%. Estimated remaining time: 50 seconds.  
Growing trees.. Progress: 99%. Estimated remaining time: 17 seconds. Growing trees.. Progress: 1%.  
Estimated remaining time: 43 minutes, 54 seconds.  
Growing trees.. Progress: 3%. Estimated remaining time: 43 minutes, 33 seconds.  
Growing trees.. Progress: 4%. Estimated remaining time: 41 minutes, 4 seconds.  
Growing trees.. Progress: 5%. Estimated remaining time: 40 minutes, 47 seconds.  
Growing trees.. Progress: 7%. Estimated remaining time: 39 minutes, 27 seconds.  
Growing trees.. Progress: 8%. Estimated remaining time: 38 minutes, 34 Growing trees.. Progress: 9%.  
Estimated remaining time: 37 minutes, 54 seconds.  
Growing trees.. Progress: 11%. Estimated remaining time: 37 minutes, 10 seconds.  
Growing trees.. Progress: 12%. Estimated remaining time: 36 minutes, 55 seconds.  
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## Data Analytics

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## Basic testing model

Model	Error
k-NN	0.638315
LASSO	0.635483
SVM	0.445464
Random Forest	0.396741
Boosting	0.382399

## Weighted Average

Model	Error
Best RF	0.396415

## Data Analytics

Best BST	0.382642
Mean RF	0.396803
Mean BST	0.382934
Best RF + BST	0.380572
Mean RF + BST	0.381167

## Stacked Generalization

1. Split the training dataset in to  $k$  folds.
2. For  $i$ -th fold of training data, train models with each of the level-0 learners on the rest of the training data.
3. Make predictions using the models we trained:
  - make predictions on  $i$ -th fold of data.
  - make predictions on the test set.
4. Repeat 2. and 3. until we used all  $k$  folds of training data.
5. Generate the level-1 data using predictions we obtained:
  - generate level-1 training data by concatenating the predictions we made on each fold of the training data.
  - generate level-1 test data by averaging the predictions we made on the test set.
6. Train a level-1 generalizer using the level-1 data and the correct responses, make predictions.

Model	Error
LV-1 k-NN	0.631110
LV-1 LASSO	0.624957
LV-1 SVM	0.443895
LV-1 RF	0.393018
LV-1 BST	0.379804
Stacked	0.382274

## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

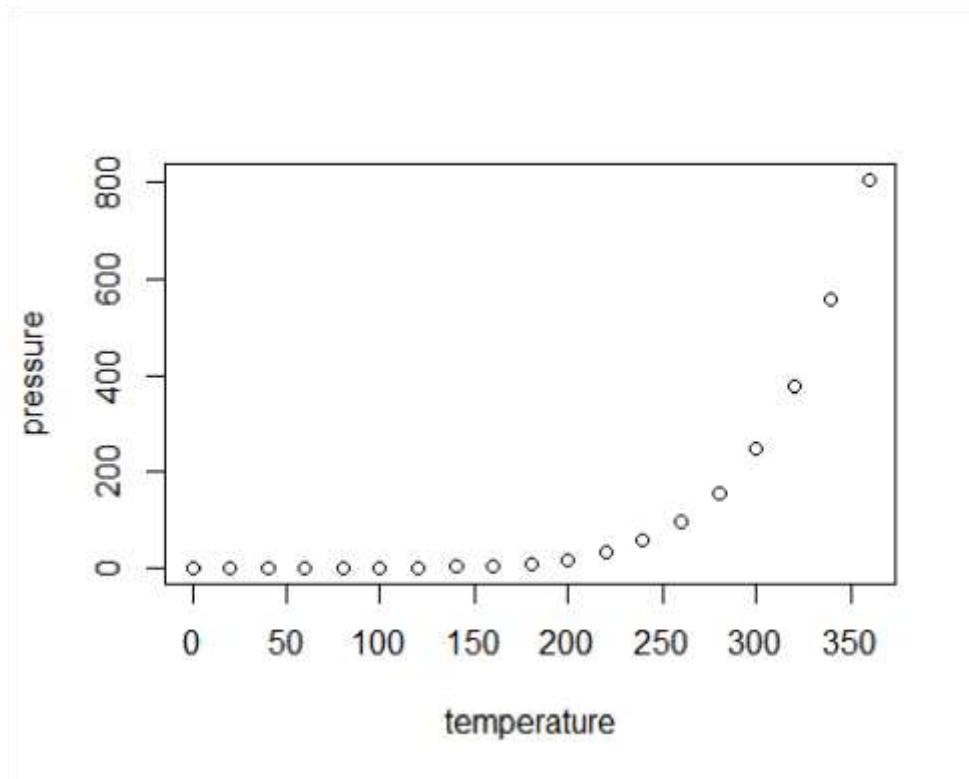
When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
#
##   speed      dist
## Min.   :4.0  Min.   : 2.00
## 1st Qu.:12.0 1st Qu.: 26.00
## Median :15.0 Median : 36.00
## Mean   :15.4 Mean   : 42.98
## 3rd Qu.:19.0 3rd Qu.: 56.00
## Max.   :25.0 Max.   :120.00
```

## Including Plots

You can also embed plots, for example:





Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

## 6. Expected Format

1. R file should be submitted where applicable.
2. R file should be in PDF or in .r format
3. Proper screenshots of the outputs should be submitted as well
4. The r codes, if submitted in any other format, will be subjected to deduction in marks

Note: Your solution will not be entertained if it is any other format, e.g., .zip, .doc, .rtf etc.

## 11. 7. Approximate Time to Complete Task

20 mins.

## **12. Expected Format**

1. R file should be submitted where applicable.
2. R file should be in PDF or in .r format
3. Proper screenshots of the outputs should be submitted as well
4. The r codes, if submitted in any other format, will be subjected to deduction in marks

Note: Your solution will not be entertained if it is any other format, e.g., .zip, .doc, .rtf etc.

## **13. Approximate Time to Complete Task**

20 mins.