Hackthon 6

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Abstract

During a 10 day period, a deployed estimator received new data and outcomes.

The received data had significant differences from the data used in training, but the model was still able to produce a reasonable estimation of the outcomes, the AUC ROC score was 0.8752.

Using the new data and outcomes to retrain the data does not result in a large improvement, but should progressively increase as more outcomes arrive.

1 Intro

In a previous report we analysed a dataset with characteristics of an unknown population and if they became unemployed in the next 12 months. We will assume knowledge of this report, if you are not familiar please read it.

Several predictived models were tested and one was selected. This model was deployed online to receive further data during a 10 day period. In this time we received both more population samples and outcomes.

In this report we analyse the behaviour of our deployed model in light of the new information.

2 Exploratory data analysis

During this 10 day period we received 9943 new samples and 498 new outcomes. In this section we will have a look at the new data and check for any anomalies relative to the original data used to train the model.

Having a look at the data (appendix A on page 4) it's easy too spot that there are significant differences from the data used to train our model. We now have samples with *eaned dividends* and different genders. The proportions of the categories for *domestic relationship type* and *domestic status* do not match. There are also some changes in *job types* and *profession* This is a considerable amount of change for our model to deal with.

3 Model Analysis

Our model achieved an AUC ROC score of:

0.8752

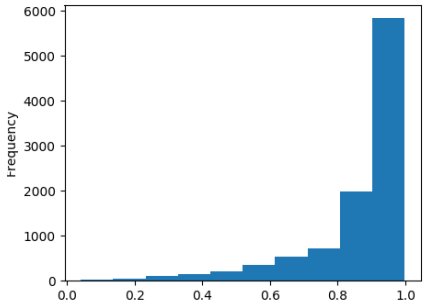
Taking in consideration that the new population profile does no match the one for which our model was trainned for it is still a high score.

We can also have a look at the output of the model for the samples independently of our knowledge of the outcome. Ideally our models should give a loot more outcomes near 0 and 1 than in the middle. So lets look at the histogram of our *proba* output in fig. 1a.

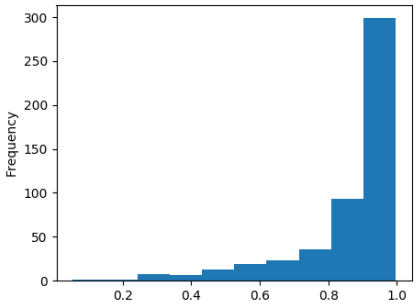
While most of our outputs are near the edge, we see that this is only happening towards 1. This could mean that our new samples are a skewed view of the population or that the population itself is skewed toward 1 (becoming unemployed during the 12 moth period after the sample is collected). So lets compare with the histogram for the samples for which we do know the outcome (fig. 1b) and the true outcomes (fig. 1c).

Figure 1: Outcome and *proba* histograms.

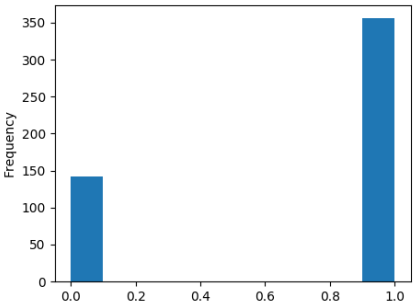
(a) New samples *proba*.



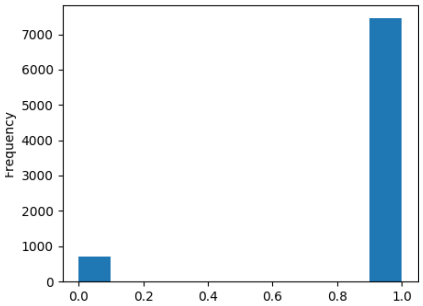
(b) New samples with outcomes *proba*.



(c) New outcomes.

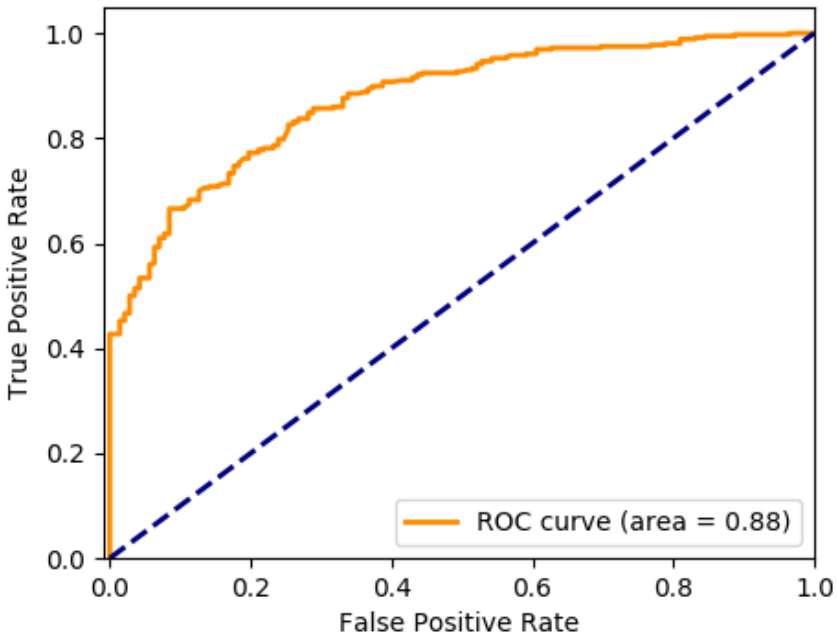


(d) Original outcomes.



We can see that we are not in an ideal situation, our population outcomes are skewed, we have to be extra careful. But the AUC ROC score and the RUC curve (fig. 2 on the following page) tells us that we should have a good predictive capability by carefully selecting a threshold.

Figure 2: ROC curve.



4 Retraining

We joined the new data (with outcomes) with the old and split into training and test sets. Afterward we trained the same model (GradientBoostingClassifier) with the new data to compare the score with our deployed estimator, see table 1.

Table 1: Estimator AUC ROC scores.

Deployed estimator	0.9182
New estimator	0.9232

As we can see there is not a big difference, but there is so little new data that this just means that no new ”insights” came from the new data.

A Tables & Figures

Table 2: Country of origin top 10.

(a) Original dataset.

u.s.	7330
unknown	126
mexico	111
philippines	60
de	50
puerto rico	39
jamaica	34
cuba	34
el-salvador	30
canada	28

(b) New dataset.

u.s.	8935
mexico	210
unknown	185
philippines	53
de	39
india	37
canada	32
gb	32
puerto rico	30
el-salvador	29

(c) New dataset samples with target.

u.s.	452
mexico	9
unknown	8
de	4
india	3
hong	2
puerto rico	2
poland	2
china	2
ireland	2

Table 3: Domestic relationship type value counts.

(a) Original dataset.

not living with family	2919
never married	2063
living with child	1750
has husband	1106
living with extende family	325
has wife	1

(b) New dataset.

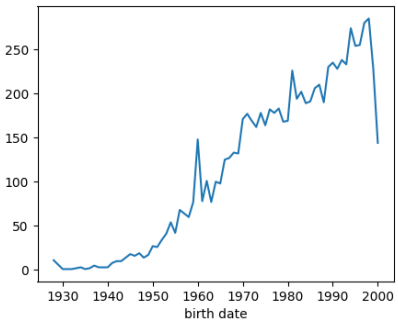
has wife	5398
not living with family	2227
living with child	1353
never married	532
living with extende family	245
has husband	188

(c) New dataset samples with target.

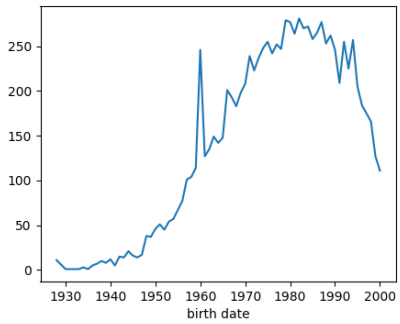
has wife	266
not living with family	119
living with child	66
never married	23
living with extende family	14
has husband	10

Figure 3: Birth date histograms.

(a) Original samples.



(b) New samples.



(c) New samples with outcomes.

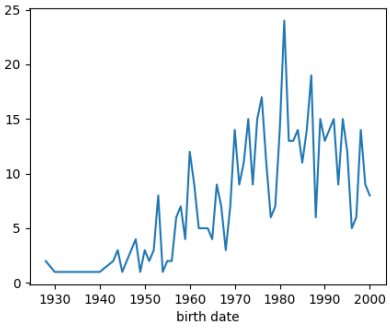


Table 4: Domestic status value counts.

(a) Original dataset.

single	3662
d	2073
married 2	1170
spouse passed	599
divorce pending	486
married not together	163
married 1	11

(b) New dataset.

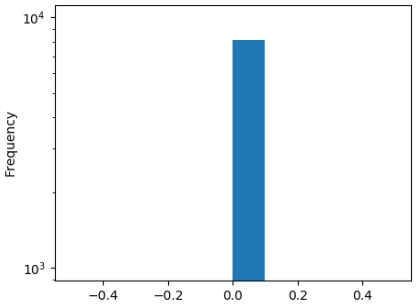
married 2	5645
single	2853
d	983
divorce pending	211
spouse passed	154
married not together	93
married 1	4

(c) New dataset samples with target.

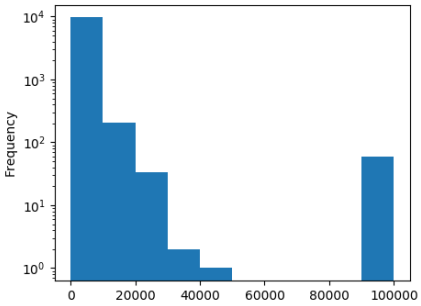
married 2	281
single	145
d	52
spouse passed	8
married not together	6
divorce pending	6

Figure 4: Earned dividends histograms.

(a) Original samples.



(b) New samples.



(c) New samples with outcomes.

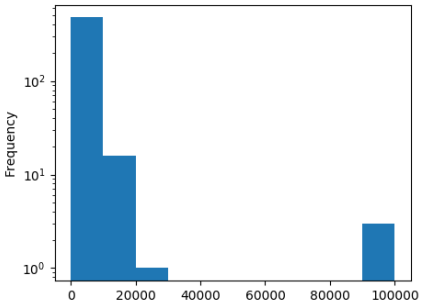


Table 5: Ethnicity value counts.

(a) Original dataset.

white and privileged	6523
afro american	1210
asian	262
american indian	88
other	81

(b) New dataset.

white and privileged	8679
afro american	778
asian	315
american indian	92
other	79

(c) New dataset samples with target.

white and privileged	431
afro american	46
asian	17
american indian	2
other	2

Table 6: Gender value counts.

(a) Original dataset.

Female	8164

(b) New dataset.

Male	8904
Female	1039

(c) New dataset samples with target.

Male	453
Female	45

Table 7: Job type value counts.

(a) Original dataset.

private	5919
unknown	620
local-gov	618
state-gov	368
self-emp-not-inc	303
federal-gov	236
self-emp-inc	94
without-pay	4
never-worked	2

(b) New dataset.

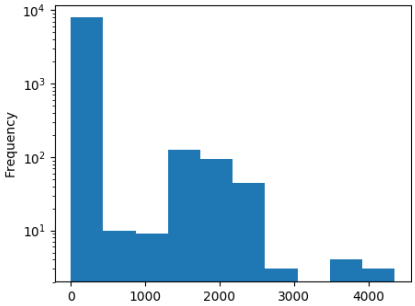
private	6824
self-emp-not-inc	905
local-gov	573
unknown	489
self-emp-inc	426
state-gov	415
federal-gov	304
without-pay	4
never-worked	3

(c) New dataset samples with target.

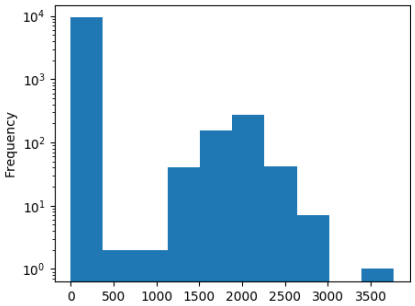
private	341
self-emp-not-inc	44
unknown	28
local-gov	28
self-emp-inc	24
state-gov	20
federal-gov	13

Figure 5: Interest earned histograms.

(a) Original samples.



(b) New samples.



(c) New samples with outcomes.

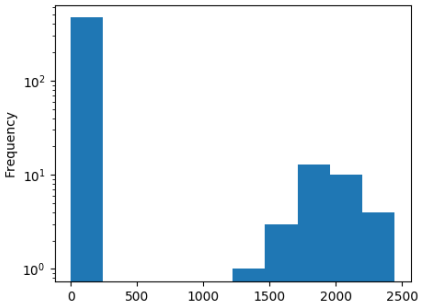
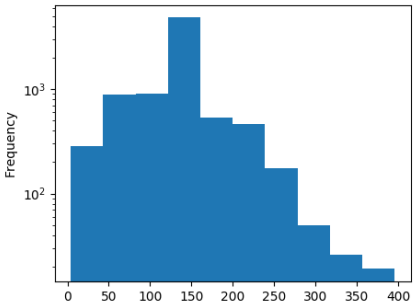
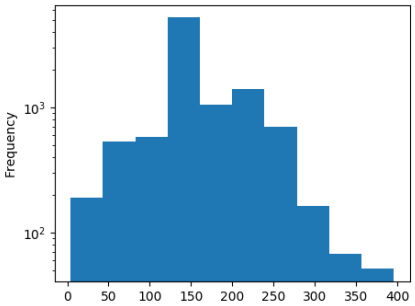


Figure 6: Monthly work histograms.

(a) Original samples.



(b) New samples.



(c) New samples with outcomes.

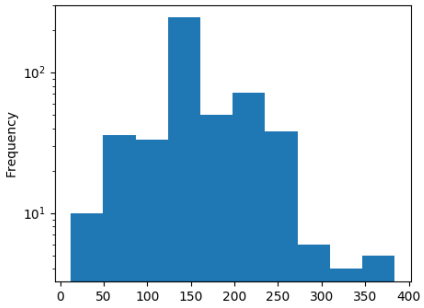


Table 8: Profession value counts.

(a) Original dataset.

secretarial	1949
other	1423
specialist technician	1096
sales	978
C-level	842
unknown	622
mechanic	420
technology support	247
vocational	184
household labor	131
estate employee	108
defense contractor	58
trucking	58
agriculture	48

(b) New dataset.

vocational	1561
C-level	1316
specialist technician	1213
sales	1112
other	780
secretarial	736
trucking	666
mechanic	637
household labor	501
unknown	492
agriculture	388
technology support	279
defense contractor	244
estate employee	16
army	2

(c) New dataset samples with target.

C-level	68
vocational	68
sales	64
specialist technician	49
other	42
trucking	38
household labor	33
mechanic	30
secretarial	29
unknown	28
defense contractor	18
agriculture	17
technology support	13
army	1

Table 9: School level value counts.

(a) Original dataset.

secondary	2594
entry level college	2165
college graduate	1188
basic vocational	373
some post graduate	355
secondary 11	341
advanced vocational	326
10th	248
secondary-7 through 8	123
secondary 12	106
secondary-9	104
secondary-5 through 6	72
advanced post graduate	61
primary school	58
primary 1 through 4	37
kindergarten	13

(b) New dataset.

secondary	3243
entry level college	2087
college graduate	1691
some post graduate	577
basic vocational	402
secondary 11	317
advanced vocational	303
10th	277
secondary-7 through 8	208
primary school	202
secondary-9	172
advanced post graduate	142
secondary 12	140
secondary-5 through 6	117
primary 1 through 4	49
kindergarten	16

(c) New dataset samples with target.

secondary	179
entry level college	110
college graduate	76
some post graduate	26
secondary 11	20
primary school	13
10th	12
advanced vocational	11
secondary 12	10
secondary-9	9
basic vocational	9
advanced post graduate	8
secondary-5 through 6	5
secondary-7 through 8	5
kindergarten	3
primary 1 through 4	2