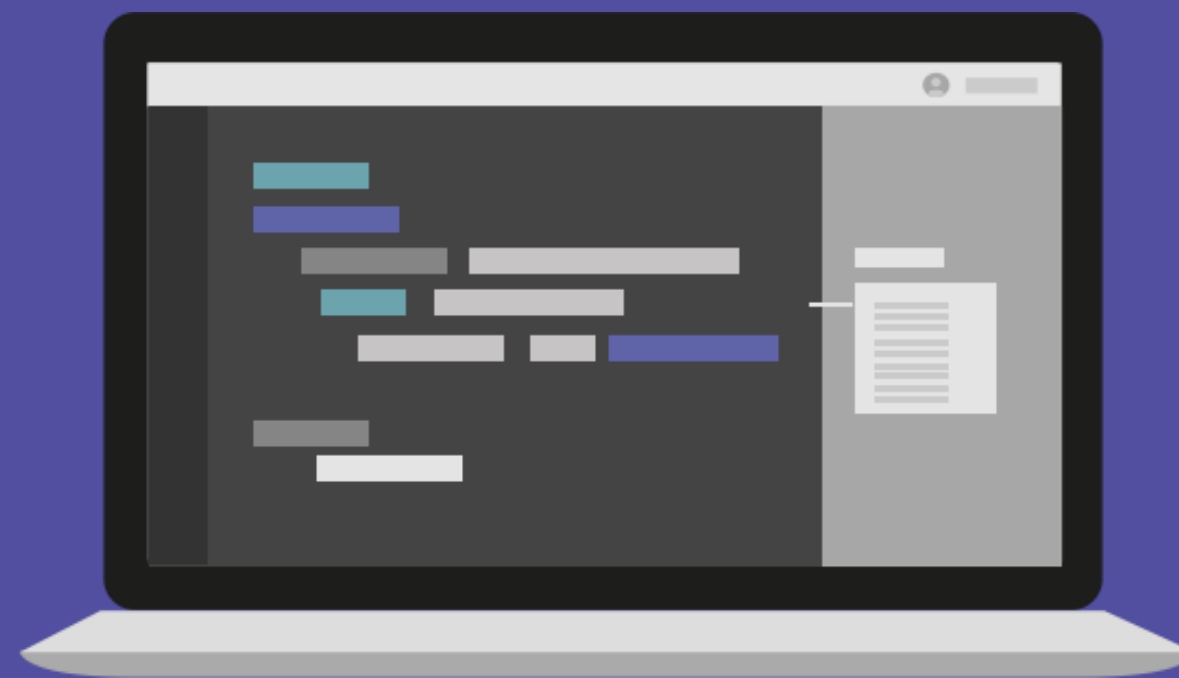


[실습] 누구에게 프로모션을 제공해야 할까?



# Bank Target Marketing 데이터 소개

- 1) 포르투갈의 기관 은행에서 진행한 마케팅 관련 데이터
- 2) Phone call을 통한 마케팅 프로모션 진행
- 3) Target은 마케팅을 통해 정기예금(term deposit)을 가입했는지 가입여부 의미



Source:

[Moro et al., 2014] S. Moro, P. Cortez and P. Rita. A Data-Driven Approach to Predict the Success of Bank Telemarketing. Decision Support Systems, Elsevier, 62:22-31, June 2014

# 실습 특징

- 1) 실습을 위해서 총 45,211명의 데이터에서 41,259명의 데이터를 사용하여 머신러닝 모델 학습
- 2) 학습한 모델을 이용하여 나머지 3,952명에 대한 정기예금 가입여부를 예측
- 3) 예측된 결과를 이용하여 기대손익 계산

# 스위치 소개

## handling\_missing\_value

	결측치 비율(%)	결측치 수
age	0.00	0
job	0.80	330
marital	0.19	80
education	4.20	1731
default	20.87	8597
housing	2.40	990
loan	2.40	990
contact	0.00	0
month	0.00	0
day_of_week	0.00	0
duration	0.00	0
campaign	0.00	0
pdays	0.00	0
previous	0.00	0
poutcome	0.00	0
emp.var.rate	0.00	0
cons.price.idx	0.00	0
cons.conf.idx	0.00	0
euribor3m	0.00	0
nr.employed	0.00	0
y	0.00	0

# handling\_missing\_value

## False

age	job	marital	education	default	housing	loan	contact	month	day_of_week	duration	campaign	pdays	previous	outcome	emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed	y
56	housemaid	married	basic.4y	no	no	no	telephone	may	mon	261	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
57	services	married	high.school	NaN	no	no	telephone	may	mon	149	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
37	services	married	high.school	no	yes	no	telephone	may	mon	226	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
40	admin.	married	basic.6y	no	no	no	telephone	may	mon	151	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
56	services	married	high.school	no	no	yes	telephone	may	mon	307	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
45	services	married	basic.9y	NaN	no	no	telephone	may	mon	198	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
59	admin.	married	professional.course	no	no	no	telephone	may	mon	139	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
41	blue-collar	married	NaN	NaN	no	no	telephone	may	mon	217	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
24	technician	single	professional.course	no	yes	no	telephone	may	mon	380	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
25	services	single	high.school	no	yes	no	telephone	may	mon	50	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0

# handling\_missing\_value

True

age	job	marital	education	default	housing	loan	contact	month	day_of_week	duration	campaign	pdays	previous	outcome	emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed	y
56	housemaid	married	basic.4y	no	no	no	telephone	may	mon	261	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
57	services	married	high.school	no	no	no	telephone	may	mon	149	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
37	services	married	high.school	no	yes	no	telephone	may	mon	226	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
40	admin.	married	basic.6y	no	no	no	telephone	may	mon	151	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
56	services	married	high.school	no	no	yes	telephone	may	mon	307	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
45	services	married	basic.9y	no	대치됨	no	telephone	may	mon	198	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
59	admin.	married	professional.course	no	no	no	telephone	may	mon	139	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
제거됨																				
24	technician	single	professional.course	no	yes	no	telephone	may	mon	380	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
25	services	single	high.school	no	yes	no	telephone	may	mon	50	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0
25	services	single	high.school	no	yes	no	telephone	may	mon	222	1	999	0	nonexistent	1.1	93.994	-36.4	4.857	5191.0	0

# add\_age\_categorical

True

cons.conf.idx	euribor3m	nr.employed	y	age_cat
-36.4	4.857	5191.0	0	3
-36.4	4.857	5191.0	0	3
-36.4	4.857	5191.0	0	2
-36.4	4.857	5191.0	0	2
-36.4	4.857	5191.0	0	3
-36.4	4.857	5191.0	0	2
-36.4	4.857	5191.0	0	3
-36.4	4.857	5191.0	0	1
-36.4	4.857	5191.0	0	1
-36.4	4.857	5191.0	0	1

# add\_marketing\_info

True

age	job	marital	education	default	housing	loan	contact	month	day_of_week	duration	campaign	pdays	previous	poutcome
56	housemaid	married	basic.4y	no	no	no	telephone	may	mon	261	1	999	0	nonexistent
57	services	married	high.school	no	no	no	telephone	may	mon	149	1	999	0	nonexistent
37	services	married	high.school	no	yes	no	telephone	may	mon	226	1	999	0	nonexistent
40	admin.	married	basic.6y	no	no	no	telephone	may	mon	151	1	999	0	nonexistent
56	services	married	high.school	no	no	yes	telephone	may	mon	307	1	999	0	nonexistent
45	services	married	basic.9y	no	no	no	telephone	may	mon	198	1	999	0	nonexistent
59	admin.	married	professional.course	no	no	no	telephone	may	mon	139	1	999	0	nonexistent
24	technician	single	professional.course	no	yes	no	telephone	may	mon	380	1	999	0	nonexistent
25	services	single	high.school	no	yes	no	telephone	may	mon	50	1	999	0	nonexistent
25	services	single	high.school	no	yes	no	telephone	may	mon	222	1	999	0	nonexistent

추가됨



# add\_social\_economic\_info

True

emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed
-1.8	93.876	-40.0	0.699	5008.7
-3.4	92.379	-29.8	0.788	5017.5
1.1	93.994	-36.4	4.856	5191.0
-1.7	94.215	-40.3	0.893	4991.6
1.4	93.918	-42.7	4.968	5228.1
-1.7	94.215	-40.3	0.782	4991.6
1.1	93.994	-36.4	4.857	5191.0
1.1	93.994	-36.4	4.860	5191.0
1.4	94.465	-41.8	4.959	5228.1
-0.1	93.200	-42.0	4.021	5195.8

추가됨

# add\_marketing\_info

True

emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed	education	default	housing	loan	contact	month	day_of_week	duration	campaign	pdays	previous	outcome
-1.8	93.876	-40.0	0.699	5008.7	basic.4y	no	no	no	telephone	may	mon	261	1	999	0	nonexistent
-3.4	92.379	-29.8	0.788	5017.5	basic.4y	no	no	no	telephone	may	mon	149	1	999	0	nonexistent
1.1	93.994	-36.4	4.856	5191.0	basic.4y	no	no	no	telephone	may	mon	226	1	999	0	nonexistent
-1.7	94.215	-40.3	0.893	4991.6	basic.4y	no	no	no	telephone	may	mon	151	1	999	0	nonexistent
1.4	93.918	-42.7	4.968	5228.1	basic.4y	no	yes	no	telephone	may	mon	307	1	999	0	nonexistent
-1.7	94.215	-40.3	0.782	4991.6	basic.4y	no	yes	no	telephone	may	mon	198	1	999	0	nonexistent
1.1	93.994	-36.4	4.857	5191.0	basic.6y	no	no	no	telephone	may	mon	139	1	999	0	nonexistent
1.1	93.994	-36.4	4.860	5191.0	basic.6y	no	no	no	telephone	may	mon	380	1	999	0	nonexistent
1.4	94.465	-41.8	4.959	5228.1	basic.6y	no	no	yes	telephone	may	mon	50	1	999	0	nonexistent
-0.1	93.200	-42.0	4.021	5195.8	basic.9y	no	no	no	telephone	may	mon	222	1	999	0	nonexistent
45	services	married			basic.9y	no	no	no	telephone	may	mon	139	1	999	0	nonexistent
59	admin.	married	professional.course		professional.course	no	no	no	telephone	may	mon	380	1	999	0	nonexistent
24	technician	single	professional.course		professional.course	no	yes	no	telephone	may	mon	50	1	999	0	nonexistent
25	services	single		high.school	high.school	no	yes	no	telephone	may	mon	222	1	999	0	nonexistent
25	services	single		high.school	high.school	no	yes	no	telephone	may	mon	222	1	999	0	nonexistent

# transform\_pdays\_to\_categorical

True

변환하지 않으면 해당 변수의 결측이 93%이므로 제거한다

- 0~4 → 1
- 5~9 → 2
- 10~14 → 3
- 15~19 → 4
- 20~24 → 5
- 25~ → 6
- 999 (missing value) → 7

pdays

2

7

7

1

7

3

7

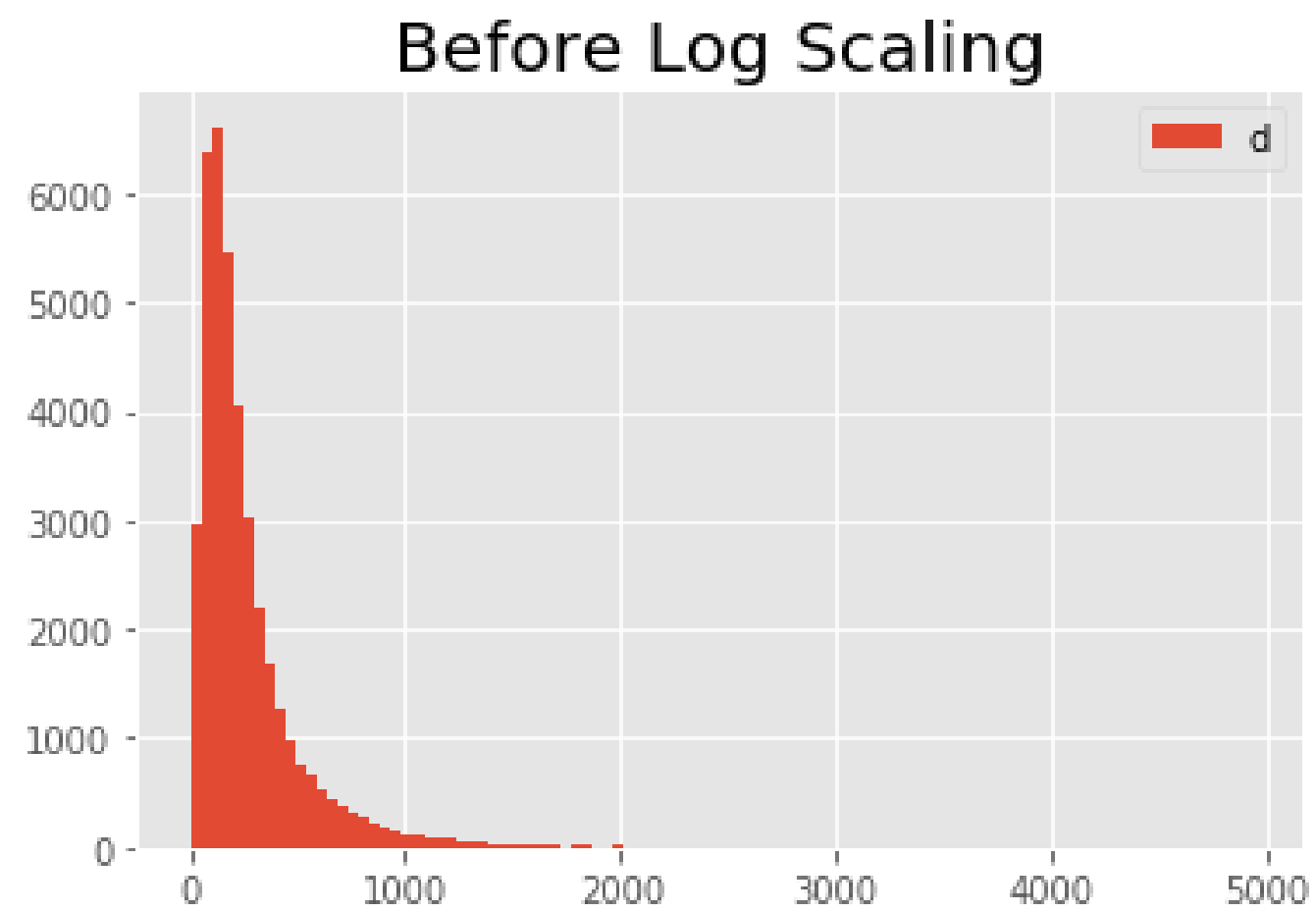
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7

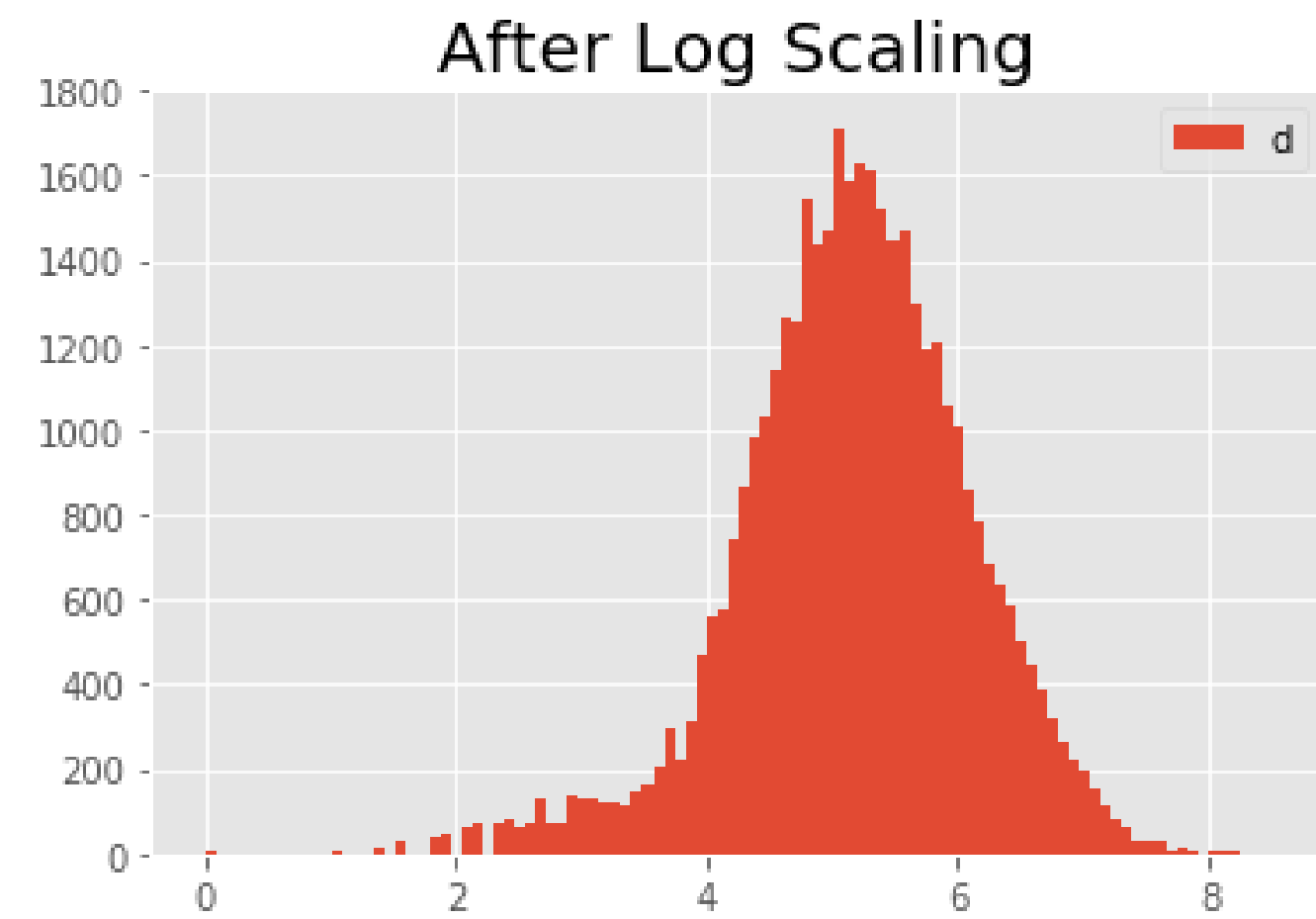
7

# transform\_duration\_to\_log\_scale

False



True



# feature\_normalization

‘minmax’

duration		duration	
0	261	0	0.053070
1	149	1	0.030297
2	226	2	0.045954
3	151	3	0.030704
4	307	4	0.062424
5	198	5	0.040260
6	139	6	0.028264
8	380	8	0.077267
9	50	9	0.010167
11	222	11	0.045140
12	137	12	0.027857

‘standard’

duration		duration	
0	261	0	0.008676
1	149	1	-0.422568
2	226	2	-0.126088
3	151	3	-0.414867
4	307	4	0.185794
5	198	5	-0.233899
6	139	6	-0.461072
8	380	7	0.466873
9	50	8	-0.803757
11	222	9	-0.141489
12	137	10	-0.468773
		11	0.131889
		12	-0.434119

`/* elice */`

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