customer_dataset

June 28, 2023

Our goal is to de-identify sensitive data found in "Customer_Survey.csv", define equivalence classes, and make calculations as to the risk posed to the individuals who's data is involved.

First we must read our data set:

```python
import pandas as pd

df = pd.read_csv('Customer_Survey.csv')

# Dataframe for Excel file
# df_xlsx = pd.read_excel('Customer_Survey.xlsx')
```

Next, we list out all of our column headers, letting us easily contextualize the data.

```python
column_names = df.columns.tolist()

for column in column_names:
    print(column)
```

```
CustomerID
Region
TownSize
Gender
Age
EducationYears
JobCategory
UnionMember
EmploymentLength
Retired
HouseholdIncome
DebtToIncomeRatio
CreditDebt
OtherDebt
LoanDefault
MaritalStatus
HouseholdSize
NumberPets
NumberCats
NumberDogs
```

NumberBirds
HomeOwner
CarsOwned
CarOwnership
CarBrand
CarValue
CommuteTime
Telecommute
PoliticalPartyMem
Votes
CreditCard
CardTenure
CardItemsMonthly
CardSpendMonthly
ActiveLifestyle
PhoneCoTenure
VoiceLastMonth
VoiceOverTenure
EquipmentRental
EquipmentLastMonth
EquipmentOverTenure
CallingCard
WirelessData
DataLastMonth
DataOverTenure
Multiline
VM
Pager
Internet
CallerID
CallWait
CallForward
ThreeWayCalling
EBilling
TVWatchingHours
OwnsPC
OwnsMobileDevice
OwnsGameSystem
OwnsFax
NewsSubscriber

We use df.describe() to help us contextualize our data. In analyzing it, we find that an outlier in one of the values - CreditDebt, where the larget value is almost double that of the second largest.

```
[ ]: df.describe()
```

```
[ ]:            Region        Gender  EducationYears  JobCategory  UnionMember  \
      count  5000.00000   5000.000000     5000.000000    5000.0000   5000.00000
```

mean	3.00140	0.503600	14.543000	2.7528	0.15120
std	1.42176	0.500037	3.281083	1.7379	0.35828
min	1.00000	0.000000	6.000000	1.0000	0.00000
25%	2.00000	0.000000	12.000000	1.0000	0.00000
50%	3.00000	1.000000	14.000000	2.0000	0.00000
75%	4.00000	1.000000	17.000000	4.0000	0.00000
max	5.00000	1.000000	23.000000	6.0000	1.00000

	EmploymentLength	Retired	HouseholdIncome	DebtToIncomeRatio \
count	5000.000000	5000.000000	5000.000000	5000.000000
mean	9.730400	0.147600	54.759600	9.954160
std	9.690929	0.354739	55.377511	6.399783
min	0.000000	0.000000	9.000000	0.000000
25%	2.000000	0.000000	24.000000	5.100000
50%	7.000000	0.000000	38.000000	8.800000
75%	15.000000	0.000000	67.000000	13.600000
max	52.000000	1.000000	1073.000000	43.100000

	CreditDebt	…	CallWait	CallForward	ThreeWayCalling \
count	5000.000000	…	5000.000000	5000.000000	5000.000000
mean	1.857326	…	0.479000	0.480600	0.478000
std	3.415732	…	0.499609	0.499673	0.499566
min	0.000000	…	0.000000	0.000000	0.000000
25%	0.385520	…	0.000000	0.000000	0.000000
50%	0.926437	…	0.000000	0.000000	0.000000
75%	2.063820	…	1.000000	1.000000	1.000000
max	109.072596	…	1.000000	1.000000	1.000000

	EBilling	TVWatchingHours	OwnsPC	OwnsMobileDevice \
count	5000.000000	5000.000000	5000.00000	5000.000000
mean	0.348600	19.645000	0.63280	0.479200
std	0.476575	5.165609	0.48209	0.499617
min	0.000000	0.000000	0.00000	0.000000
25%	0.000000	17.000000	0.00000	0.000000
50%	0.000000	20.000000	1.00000	0.000000
75%	1.000000	23.000000	1.00000	1.000000
max	1.000000	36.000000	1.00000	1.000000

	OwnsGameSystem	OwnsFax	NewsSubscriber
count	5000.000000	5000.000000	5000.000000
mean	0.474800	0.178800	0.472600
std	0.499415	0.383223	0.499299
min	0.000000	0.000000	0.000000
25%	0.000000	0.000000	0.000000
50%	0.000000	0.000000	0.000000
75%	1.000000	0.000000	1.000000
max	1.000000	1.000000	1.000000

```
[8 rows x 56 columns]
```

```
[ ]: print(df[['CustomerID', 'CreditDebt']].sort_values('CreditDebt',␣
      ↪ascending=False))
```

```
            CustomerID  CreditDebt
     1102  8402-SILWTV-4YR  109.072596
     2192  2329-EIXEIO-VD3   67.490850
     4916  4490-YKVPRY-KYA   48.704524
     4412  0052-JAKAKY-2N2   44.245560
     1770  6984-SKSZLL-0VG   42.098500
     ...              ...         ...
     4898  0974-MOYXTI-LAB    0.006344
     4046  8685-HTXFEY-GTL    0.004940
     288   8574-GUQVLV-C04    0.003410
     4921  8310-FGTMBP-9R4    0.001364
     2294  0191-AWCKTC-J5K    0.000000

     [5000 rows x 2 columns]
```

```
[ ]: 1102  8402-SILWTV-4YR  109.072596
```

Because we are only providing data usage information, as well as broad demographic information used to target audiences, we will be eliminating data that we believe can be used to identify individuals. The redacted values are: CustomerID, TownSize, UnionMember, Retired, HomeOwner, CarsOwned, CarOwnership, CarBrand, CarValue. It's clear why CustomerID is too sensitive to leave unredacted - with it, an attacker could find all other pertinent customer details. We believe, however, that the rest of the values could be combined to perform linkage attacks. Using the integers provided in TownSize, one could break them down into population ranges. With population ranges in place, an attacker could use car ownership information to help identify individuals of interest. We also believe that employment information like Union Membership data or retirement status could also help provide data that could be used to identify individuals.

Let's create our Equivalence Classes. We are interested in the ways our clients use their data. This will allow us to more effectively meet the needs of our clients, as well as allow us to better focus our advertising efforts. To start, will create Equivalence Classes defined by the following values: Age, Gender, Region, DataLastMonth, and DataOverTenure.

First, let's target adults in the following ranges:

```python
# Create a function that maps age values to age ranges
def map_age_to_range(age):
    try:
        if 24 <= age <= 34:
            return '24-34'
        elif 35 <= age <= 44:
            return '35-44'
```

```
        elif 45 <= age <= 54:
            return '45-54'
        elif 55 <= age <= 64:
            return '55-64'
        else:
            return None
    except:
        pass

df['Age'] = df['Age'].apply(map_age_to_range)
df.loc[df['Age'] != None]
```

[ ]:

	CustomerID	Region	TownSize	Gender	Age	EducationYears \
0	3964-QJWTRG-NPN	1	2	1	None	15
1	0648-AIPJSP-UVM	5	5	0	None	17
2	5195-TLUDJE-HVO	3	4	1	None	14
3	4459-VLPQUH-3OL	4	3	0	None	16
4	8158-SMTQFB-CNO	2	2	0	None	16
...	...	...	...	...	...	...
4995	3675-GZFGOT-QJN	2	2	0	None	10
4996	4699-LEPCCE-3UD	3	3	0	None	14
4997	8485-LLUICH-CVV	4	5	0	None	17
4998	9325-URAAUT-7FA	1	1	0	None	19
4999	8027-EXDZBF-OGR	3	5	1	None	10

	JobCategory	UnionMember	EmploymentLength	Retired	…	CallWait \
0	1	1	0	0	…	1
1	2	0	0	0	…	0
2	2	0	16	0	…	0
3	2	0	0	0	…	0
4	2	0	1	0	…	1
...	...	...	...	...	…	...
4995	1	0	24	0	…	0
4996	1	0	6	0	…	1
4997	1	0	24	0	…	1
4998	2	0	3	0	…	0
4999	5	0	20	0	…	0

	CallForward	ThreeWayCalling	EBilling	TVWatchingHours	OwnsPC \
0	1	1	0	13	0
1	1	0	1	18	1
2	0	0	0	21	0
3	0	0	1	26	1
4	1	1	0	27	1
...	...	...	...	...	...
4995	0	0	0	19	0
4996	1	1	0	14	0

4997	1	1	0	16	0
4998	0	0	1	24	1
4999	0	0	0	19	0

	OwnsMobileDevice	OwnsGameSystem	OwnsFax	NewsSubscriber
0	1	1	0	0
1	1	1	1	1
2	0	0	0	1
3	1	1	0	1
4	0	1	0	0
...	...	...	...	...
4995	0	0	0	1
4996	0	0	0	0
4997	0	0	0	1
4998	1	1	0	1
4999	0	0	0	0

[5000 rows x 60 columns]

```python
for index, row in df.iterrows():
    print(row['Age'])
```

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```

We will scrub the 'Other' Category to help eliminate people who fall outside of our age ranges, limiting weaknesses.

```python
[ ]: region = df.groupby('Region')
     gender = df.groupby('Gender')
     age = df.groupby('Age')
```

```python
data_last_month = df.groupby('DataLastMonth')
data_over_tenure = df.groupby('DataOverTenure')
```

```python
```

```python
# Save the masked data
df.to_csv('masked_data.csv', index=False)
```