Data Science Project

Week 8 Deliverable

Group name: Data Explorers

Specialization: Data Science

Batch: LISUM12

Team members Details:

Name	Email	Country	College\Company
Jalpa Deepak Patel	pjalpa015@gmail.com	Canada	University of Windsor
Dhvanilkumar Kiritkumar Prajapati	dkprajapati46@gmail.com	Canada	University of Ottawa
Sri Ram Prasad Commuri	csriramprasad@gmail.com	India	Data Glacier

Project Title: Bank Customer Segmentation

Problem Description: A bank wants to create customer segments/categories to send personalized Christmas offers to its customers. We need to identify feature(s) to group customers into different categories.

Customer segmentation is an approach to creating smaller customer groups relevant to the bank's product marketing and services. Based on customer accounts and usage details, sending different offers to customers increases the chances of increasing the business for a bank and reaching maximum customers as possible.

We need to create at most five customer segments. We plan to employ Data Science techniques to understand, pre-process and create customer segments.

Data Source:
https://drive.google.com/drive/folders/1bfCpJIKmp6IHxiLPWvOS2nU1dc24pViB

Data Understanding:

- The dataset consists of 47 columns.
- The dataset consists of bank customer information. It consists of different account details, customer information (age, address, gender), and information on banking services (pensions, loans, credit cards, etc.)
- The data contains information about 1,000,000 customers of XYZ bank.
- The employee information (Present, ex-employee, active, passive) is present for each customer.
- Customer Details available are –
    - Age
    - Gender
    - date of joining the bank
    - customer type (owner, co-owner)
    - customer relation (active, inactive, potential, former)
    - Residence
    - Foreigner (different birth country)
    - Deceased
    - Address
    - Gross income
- Customer account and services information present in the dataset is as follows –
    - Saving account
    - Guarantees
    - Current Account
    - Derived Account
    - Payroll account
    - Junior account
    - Particular account, particular plus account
    - Short, medium, long-term deposits
    - E-account
    - Funds
    - Mortgage
    - Pensions
    - Loans
    - Taxes
    - Credit card
    - Securities
    - Home account
    - Direct debit
- As the account types and services are present in different columns, there is a possibility that not all customers would opt for all types of accounts and services.

- The data information column wise is as follows –

```
Data columns (total 48 columns):
 #   Column                  Non-Null Count    Dtype
---  ------                  --------------    -----
 0   Unnamed: 0              1000000 non-null  int64
 1   fecha_dato              1000000 non-null  object
 2   ncodpers                1000000 non-null  int64
 3   ind_empleado            989218 non-null   object
 4   pais_residencia         989218 non-null   object
 5   sexo                    989214 non-null   object
 6   age                     1000000 non-null  object
 7   fecha_alta              989218 non-null   object
 8   ind_nuevo               989218 non-null   float64
 9   antiguedad              1000000 non-null  object
 10  indrel                  989218 non-null   float64
 11  ult_fec_cli_1t          1101 non-null     object
 12  indrel_1mes             989218 non-null   float64
 13  tiprel_1mes             989218 non-null   object
 14  indresi                 989218 non-null   object
 15  indext                  989218 non-null   object
 16  conyuemp                178 non-null      object
 17  canal_entrada           989139 non-null   object
 18  indfall                 989218 non-null   object
 19  tipodom                 989218 non-null   float64
 20  cod_prov                982266 non-null   float64
 21  nomprov                 982266 non-null   object
 22  ind_actividad_cliente   989218 non-null   float64
 23  renta                   824817 non-null   float64
 24  ind_ahor_fin_ult1       1000000 non-null  int64
 25  ind_aval_fin_ult1       1000000 non-null  int64
 26  ind_cco_fin_ult1        1000000 non-null  int64
 27  ind_cder_fin_ult1       1000000 non-null  int64
 28  ind_cno_fin_ult1        1000000 non-null  int64
 29  ind_ctju_fin_ult1       1000000 non-null  int64
```

```
 30  ind_ctma_fin_ult1      1000000 non-null  int64
 31  ind_ctop_fin_ult1      1000000 non-null  int64
 32  ind_ctpp_fin_ult1      1000000 non-null  int64
 33  ind_deco_fin_ult1      1000000 non-null  int64
 34  ind_deme_fin_ult1      1000000 non-null  int64
 35  ind_dela_fin_ult1      1000000 non-null  int64
 36  ind_ecue_fin_ult1      1000000 non-null  int64
 37  ind_fond_fin_ult1      1000000 non-null  int64
 38  ind_hip_fin_ult1       1000000 non-null  int64
 39  ind_plan_fin_ult1      1000000 non-null  int64
 40  ind_pres_fin_ult1      1000000 non-null  int64
 41  ind_reca_fin_ult1      1000000 non-null  int64
 42  ind_tjcr_fin_ult1      1000000 non-null  int64
 43  ind_valo_fin_ult1      1000000 non-null  int64
 44  ind_viv_fin_ult1       1000000 non-null  int64
 45  ind_nomina_ult1        994598 non-null   float64
 46  ind_nom_pens_ult1      994598 non-null   float64
 47  ind_recibo_ult1        1000000 non-null  int64
dtypes: float64(9), int64(24), object(15)
```

NULL Values –

- The null values columns are Employee Index, Customer country of residence, gender, date of customer joining, new customer index, Primary customer, late date for primary customer, customer type, address details (province, type), gross income, nominee payroll and pensions. The details are as follows –

```
ind_empleado              10782
pais_residencia           10782
sexo                      10786
fecha_alta                10782
ind_nuevo                 10782
indrel                    10782
ult_fec_cli_1t           998899
indrel_1mes               10782
tiprel_1mes               10782
indresi                   10782
indext                    10782
conyuemp                 999822
canal_entrada             10861
indfall                   10782
tipodom                   10782
```

```
cod_prov                 17734
nomprov                  17734
ind_actividad_cliente    10782
renta                   175183
ind_nomina_ult1           5402
ind_nom_pens_ult1         5402
```

Data Distribution –

Data distribution helps us determine if any outliers are present in the data and how data is arranged.

The skewness of data helps understand the probability distribution of the data. It can be performed on financial data. The distribution for the gross income of customers is not a bell shaped distribution. There are many customers whose income lies between $1202 – $300,000. The maximum income recorded is 28894395.

The distribution of numeric data is identified as follows –

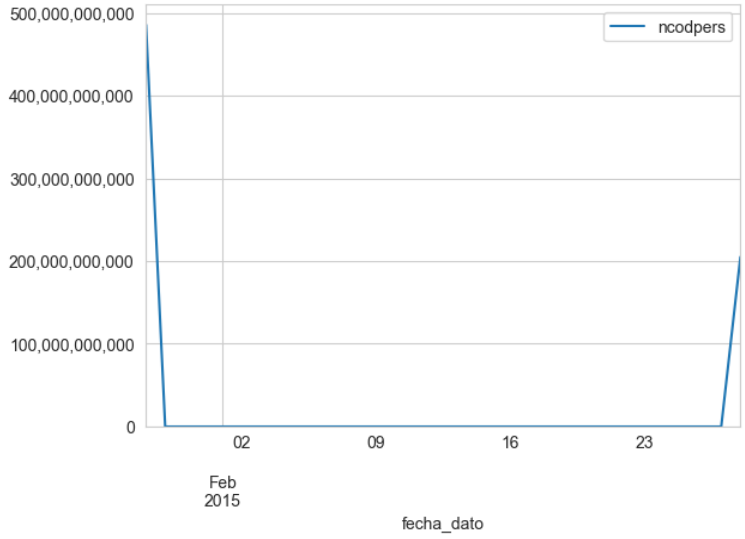
Distribution of numeric data

	count	mean	std	min	25%	50%	75%	max
ncodpers	1000000.0	690596.670395	404408.432011	15889.00	336411.00	664476.00	1074511.25	1379131.00
ind_nuevo	989218.0	0.000489	0.022114	0.00	0.00	0.00	0.00	1.00
indrel	989218.0	1.109074	3.267624	1.00	1.00	1.00	1.00	99.00
indrel_1mes	989218.0	1.000085	0.012954	1.00	1.00	1.00	1.00	3.00
tipodom	989218.0	1.000000	0.000000	1.00	1.00	1.00	1.00	1.00
cod_prov	982266.0	26.852131	12.422924	1.00	18.00	28.00	33.00	52.00
ind_actividad_cliente	989218.0	0.564971	0.495761	0.00	0.00	1.00	1.00	1.00
renta	824817.0	139646.150940	238985.824907	1202.73	71571.84	106651.86	163432.47	28894395.51
ind_ahor_fin_ult1	1000000.0	0.000177	0.013303	0.00	0.00	0.00	0.00	1.00
ind_aval_fin_ult1	1000000.0	0.000039	0.006245	0.00	0.00	0.00	0.00	1.00
ind_cco_fin_ult1	1000000.0	0.749626	0.433229	0.00	0.00	1.00	1.00	1.00
ind_cder_fin_ult1	1000000.0	0.000591	0.024303	0.00	0.00	0.00	0.00	1.00
ind_cno_fin_ult1	1000000.0	0.105296	0.306935	0.00	0.00	0.00	0.00	1.00
ind_ctju_fin_ult1	1000000.0	0.013623	0.115920	0.00	0.00	0.00	0.00	1.00
ind_ctma_fin_ult1	1000000.0	0.009894	0.098975	0.00	0.00	0.00	0.00	1.00
ind_ctop_fin_ult1	1000000.0	0.212486	0.409067	0.00	0.00	0.00	0.00	1.00
ind_ctpp_fin_ult1	1000000.0	0.072079	0.258619	0.00	0.00	0.00	0.00	1.00
ind_deco_fin_ult1	1000000.0	0.002158	0.046404	0.00	0.00	0.00	0.00	1.00
ind_deme_fin_ult1	1000000.0	0.003150	0.056036	0.00	0.00	0.00	0.00	1.00

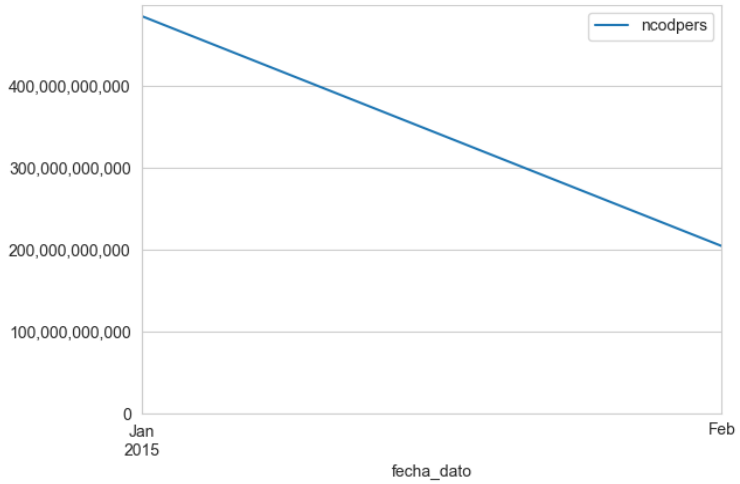
ind_dela_fin_ult1	1000000.0	0.066881	0.249816	0.00	0.00	0.00	0.00	1.00
ind_ecue_fin_ult1	1000000.0	0.106267	0.308179	0.00	0.00	0.00	0.00	1.00
ind_fond_fin_ult1	1000000.0	0.027182	0.162614	0.00	0.00	0.00	0.00	1.00
ind_hip_fin_ult1	1000000.0	0.009982	0.099410	0.00	0.00	0.00	0.00	1.00
ind_plan_fin_ult1	1000000.0	0.014553	0.119755	0.00	0.00	0.00	0.00	1.00
ind_pres_fin_ult1	1000000.0	0.004661	0.068112	0.00	0.00	0.00	0.00	1.00
ind_reca_fin_ult1	1000000.0	0.072581	0.259448	0.00	0.00	0.00	0.00	1.00
ind_tjcr_fin_ult1	1000000.0	0.066084	0.248429	0.00	0.00	0.00	0.00	1.00
ind_valo_fin_ult1	1000000.0	0.039378	0.194493	0.00	0.00	0.00	0.00	1.00
ind_viv_fin_ult1	1000000.0	0.006442	0.080003	0.00	0.00	0.00	0.00	1.00
ind_nomina_ult1	994598.0	0.071629	0.257873	0.00	0.00	0.00	0.00	1.00
ind_nom_pens_ult1	994598.0	0.079543	0.270584	0.00	0.00	0.00	0.00	1.00
ind_recibo_ult1	1000000.0	0.166275	0.372327	0.00	0.00	0.00	0.00	1.00

The time series classification of data is computed for the number of customers for the date when customer joined bank and the date the records were fetched. The results as follows –

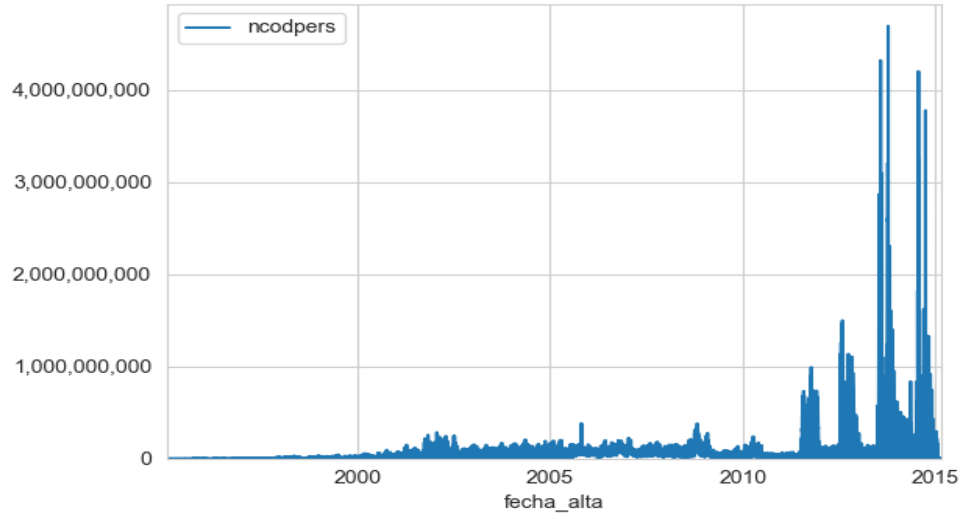
```
To check the time series of numeric data by daily, monthly and yearly
frequency
Plotting daily data
```



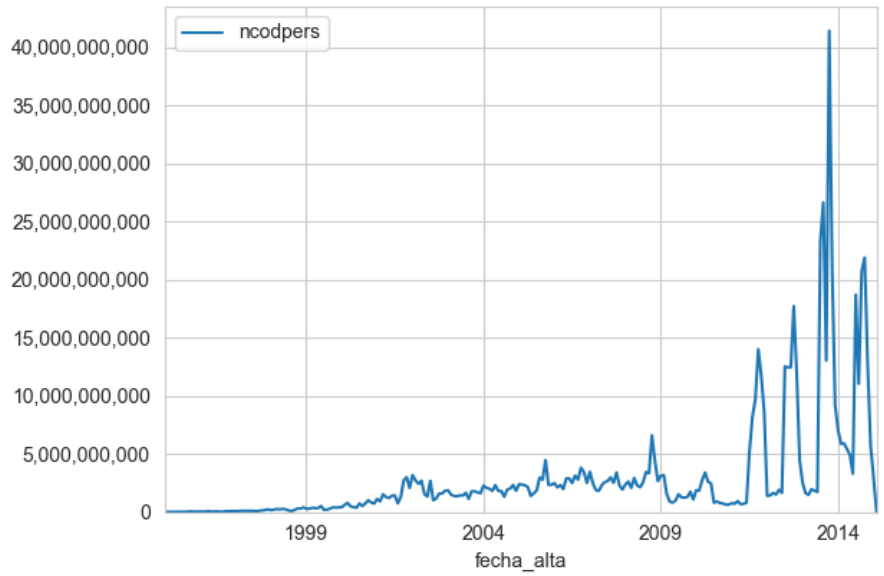
Plotting monthly data



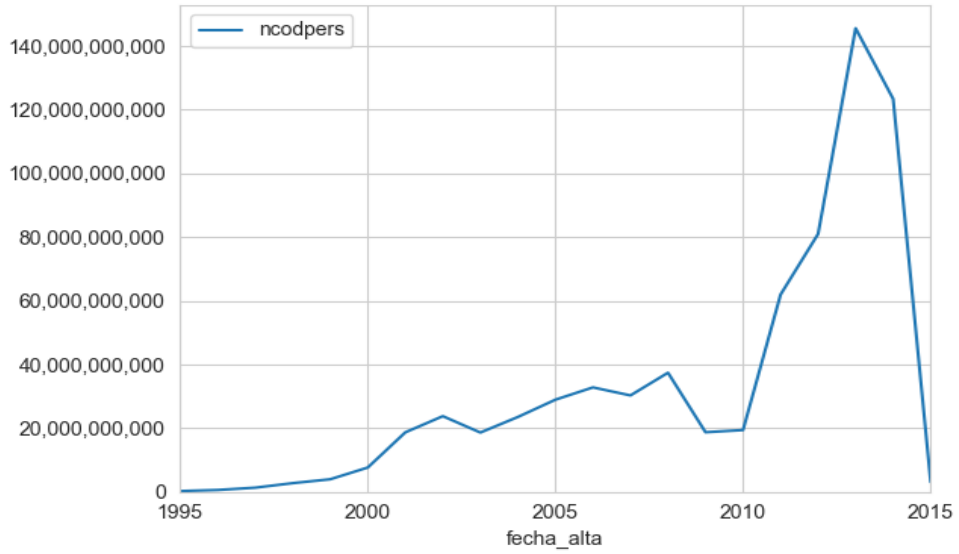
Plotting daily data



Plotting monthly data



```
Plotting yearly data
```



As observed in the graphs, the account creation of customers is not equally distributed. There was a significant increase in customers between 2010 and 2015.

Approach for Data cleaning for the upcoming week –

1. Columns with account details have Null values or 0; however, not all customers have all types of accounts and services. Hence, we can still consider information from those columns.
2. In columns such as account creation date and income, the null values can maybe be imputed by considering the mean values. We will conduct experiments to see what options fit the best.
3. We also intend to conduct experiments on treating outliers. In the initial study of data, outliers have been observed. However, by conducting a study about the bank sector and analyzing the outlier data, we decide how to treat the outlier (trimming or imputation with values).

The code for the task can be found at -
https://github.com/jalpa015/DataScience_Project/blob/master/EDA.ipynb