notebook_large

September 8, 2025

1 Import Libraries

[1]:

```
import functools
import tracemalloc
import psutil
import os
from pathlib import Path
import time
import zipfile

import httpx
import dask.dataframe as dd
import seaborn as sns
from matplotlib import pyplot as plt
```

2 Utilities

[2]:

```
def profiler(func):
    """Decorator to measure memory usage and execution time of a function."""
    @functools.wraps(func)
    def wrapper(*args, **kwargs):
        process = psutil.Process(os.getpid())

        # Start memory + time tracking
        start_mem = process.memory_info().rss / 1024**2
        tracemalloc.start()
        start_time = time.time()

        result = func(*args, **kwargs)  # run target function

        # After execution
        current, peak = tracemalloc.get_traced_memory()
        end_mem = process.memory_info().rss / 1024**2
        end_time = time.time()
        tracemalloc.stop()

        print(f"\n--- Memory Profile for `{func.__name__}` ---")
        print(f"Start memory   : {start_mem:.2f} MB")
        print(f"End memory     : {end_mem:.2f} MB")
        print(f"Peak (tracked) : {peak / 1024**2:.2f} MB")
        print(f"Execution time : {end_time - start_time:.2f} sec")
        print("------------------------------------------\n")

        return result
    return wrapper
```

[3]:

```
# Constants

ROOT_PATH = Path(os.getcwd())
GDRIVE_ID = "1IXQDp8Um3d-o7ysZLxkDyuvFj9gtlxqz"
ARCHIVE_OUTPUT_PATH = ROOT_PATH / "dataset.zip"
DATASET_OUTPUT_PATH = ROOT_PATH / "customers-2000000.csv"
```

[4]:

```
@profiler
def unzip_file(zip_path):
    # Check if the ZIP file exists
    if not os.path.exists(zip_path):
        raise FileNotFoundError(f"ZIP file not found: {zip_path}")

    # If no extraction directory specified, use the ZIP file's directory
    extract_to = "."

    # Extract the ZIP file
    with zipfile.ZipFile(zip_path, 'r') as zip_ref:
        zip_ref.extractall(extract_to)
        print(f"Successfully extracted {zip_path} to {extract_to}")

        # Optional: Print extracted files
        extracted_files = zip_ref.namelist()
        print(f"Extracted {len(extracted_files)} files:")
        for file in extracted_files[:5]:  # Show first 5 files
            print(f"  - {file}")
        if len(extracted_files) > 5:
            print(f"  ... and {len(extracted_files) - 5} more files")

    return os.path.abspath(extract_to)


@profiler
def load_data(file_path: Path, **kwargs) -> dd.DataFrame:
    return dd.read_csv(file_path, **kwargs)
```

3 EDA

3.1 Data Loading

[ ]:

```
# Data Loading
!gdown 1IXQDp8Um3d-o7ysZLxkDyuvFj9gtlxqz -O dataset.zip
```

[ ]:

```
# Unzip File
unzip_file(ARCHIVE_OUTPUT_PATH)
```

[5]:

```
# Data Parsing
df = load_data(DATASET_OUTPUT_PATH, index_col=False)
df = df.set_index("Index")
```

```
--- Memory Profile for `load_data` ---
Start memory   : 169.54 MB
End memory     : 173.22 MB
Peak (tracked) : 1.16 MB
Execution time : 0.07 sec
------------------------------------------
```

3.2 Data Understanding

[15]:

```
# Number of rows (requires computation)
nrows = df.shape[0].compute()

# Number of columns (fast, metadata only)
ncols = len(df.columns)

print((nrows, ncols))
```

```
(2000000, 11)
```

[ ]:

```
df.head()
```

[6]:

```
df.npartitions
```

[6]:

```
5
```

3.3 Data Cleaning and Preparation

[7]:

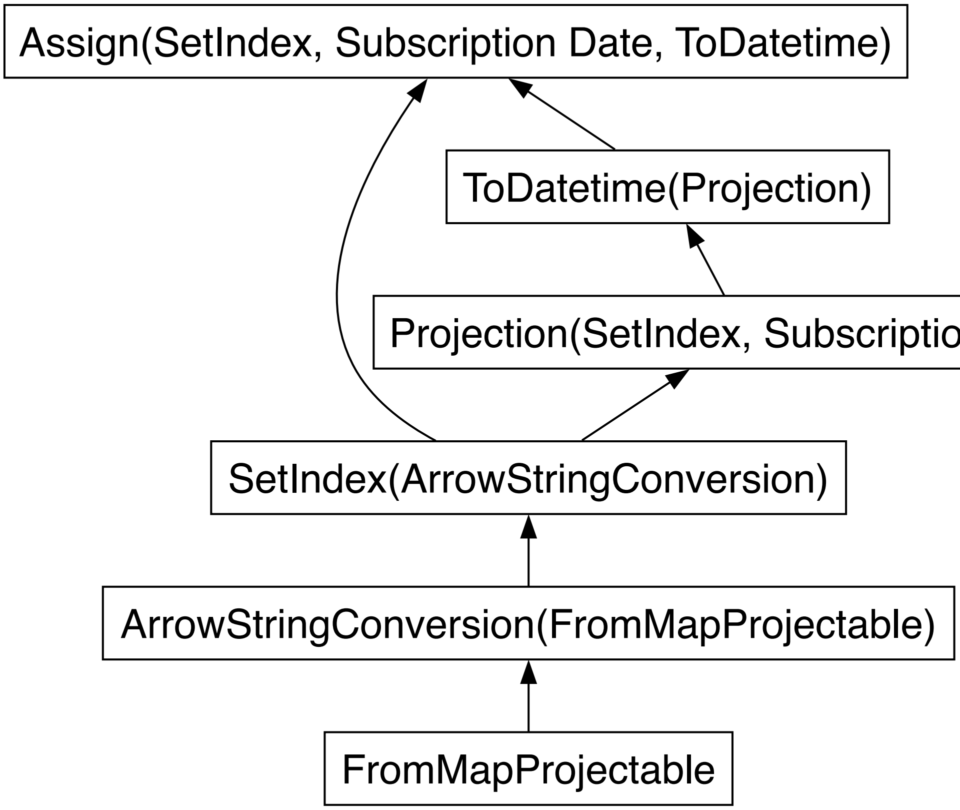
```
# Parsing to date
@profiler
def parse_date(df: dd.DataFrame, col: str):
    df[col] = dd.to_datetime(df[col])

parse_date(df, "Subscription Date")
```

```
--- Memory Profile for `parse_date` ---
Start memory    : 295.46 MB
End memory      : 293.02 MB
Peak (tracked)  : 0.07 MB
Execution time  : 0.03 sec
------------------------------------------
```

[8]:

```
df.visualize()
```

[8]:


Assign(SetIndex, Subscription Date, ToDatetime)
ToDatetime(Projection)
Projection(SetIndex, Subscription Date)
SetIndex(ArrowStringConversion)
ArrowStringConversion(FromMapProjectable)
FromMapProjectable

[17]:

```
df.head()
```

[17]:

```
          Customer Id First Name Last Name                 Company  \
Index
1     4962fdbE6Bfee6D        Pam    Sparks            Patel-Deleon
2     9b12Ae76fdBc9bE       Gina     Rocha  Acosta, Paul and Barber
3     39edFd2F60C85BC    Kristie     Greer               Ochoa PLC
4     Fa42AE6a9aD39cE     Arthur    Fields              Moyer-Wang
5     F5702Edae925F1D   Michelle   Blevins           Shah and Sons

                   City                                     Country  \
Index
1            Blakemouth  British Indian Ocean Territory (Chagos Archipe…
2      East Lynnchester                                         Costa Rica
3           West Pamela                                            Ecuador
4          East Belinda                                        Afghanistan
5            West Jared                                   Marshall Islands

                      Phone 1                Phone 2  \
Index
1            267-243-9490x035       480-078-0535x889
2                027.142.0940  +1-752-593-4777x07171
3        +1-049-168-7497x5053        +1-311-216-7855
4      001-653-754-7486x65787       521-630-3858x953
5                  8735278329      (633)283-6034x500

                               Email Subscription Date  \
Index
1      nicolas00@faulkner-kramer.com        2020-11-29
2                 yfarley@morgan.com        2021-01-03
3              jennyhayden@petty.org        2021-06-20
4              igrimes@ruiz-todd.org        2020-02-13
5           diamondcarter@jordan.com        2020-10-20

                          Website
Index
1             https://nelson.com/
2      https://pineda-rogers.biz/
3           https://mckinney.com/
4          https://dominguez.biz/
5        http://murillo-ryan.com/
```