Capstone Project 1

BIGDATA ENGINEERING

by

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Business Objectives

- Basic Exploratory Analysis on different metrics available to get insights at the Employee level as well as Department levels.
- To analysis the various factors connected to the Employee's Leaving and improve on those parameters viz Salary, Last Performance Ratings, Years of Service (Tenure), No of projects etc.
- Technology-wise Objective : **Creating an End-to-End Pipeline** to enhance the automation to do quick analysis and manage all the repetitive actions in a proper-structured manner.

Data Description

This dataset has total 6 tables (Records) –

1. Employees (300024),
2. Salaries (300024),
3. Titles (7),
4. Dept_Emp (331603 -> 300024),
5. Dept_Manager (24) and
6. Departments (9).

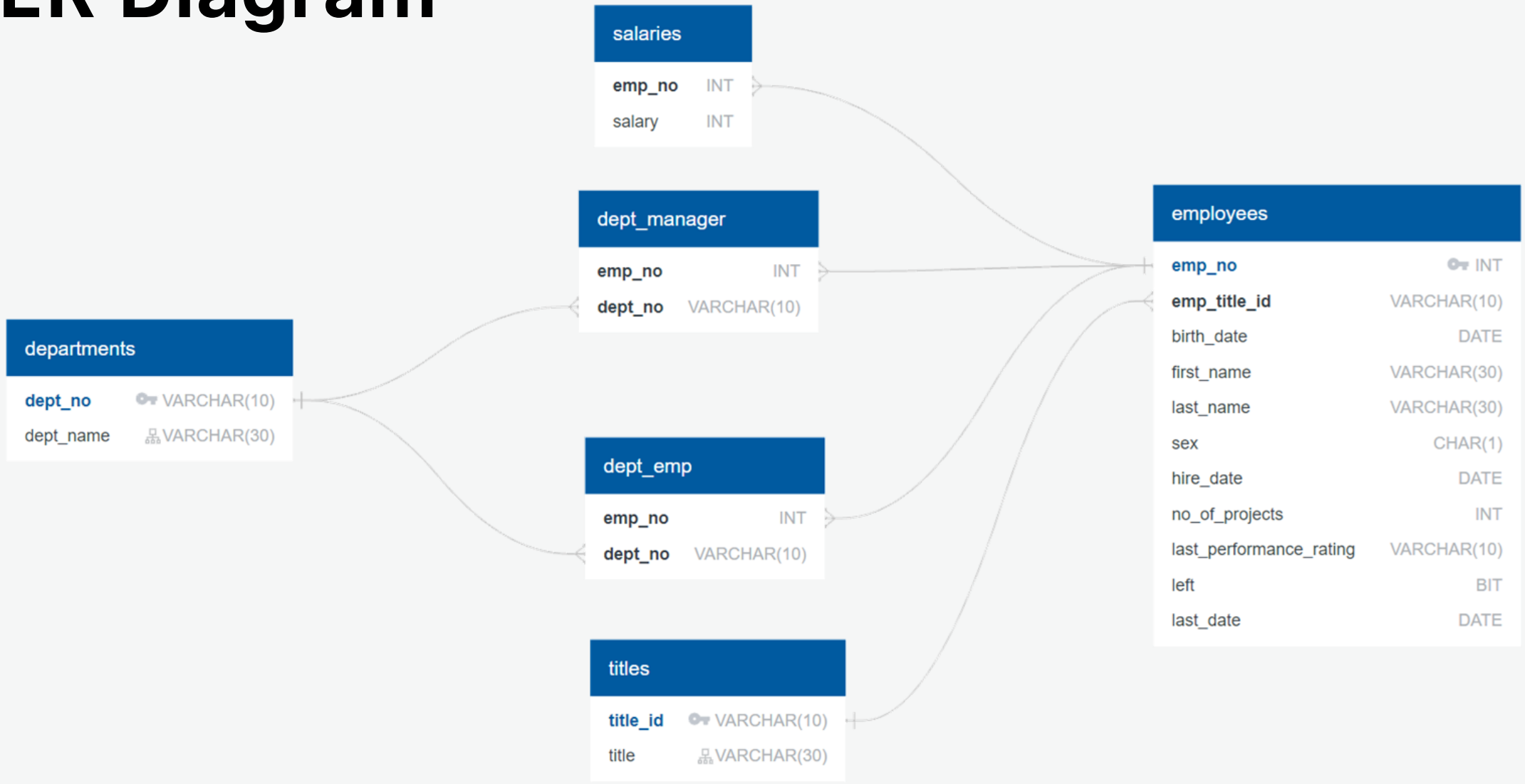
Data Description

1. **Titles (titles.csv):**
   a. **title_id** – Unique id of type of employee (designation id) – Character – Not Null
   b. **title** – Designation – Character – Not Null
2. **Employees (employees.csv):**
   a. **emp_no** – Employee Id – Integer – Not Null
   b. **emp_titles_id** – designation id – Not Null
   c. **birth_date** – Date of Birth – Date Time – Not Null
   d. **first_name** – First Name – Character – Not Null
   e. **last_name** – Last Name – Character – Not Null
   f. **sex** – Gender – Character – Not Null
   g. **hire_date** – Employee Hire date –Date Time -Not Null
   h. **no_of_projects** – Number of projects worked on – Integer – Not Null
   i. **Last_performance_rating** – Last year performance rating – Character – Not Null
   j. **left** – Employee left the organization – Boolean – Not Null
   k. **Last_date** - Last date of employment (Exit Date) – Date Time
3. **Salaries (salaries.csv):**
   a. **emp_no** – Employee id – Integer – Not Null
   b. **Salary** – Employee's Salary – Integer – Not Null
4. **Departments (departments.csv)**
   a. **dept_no** - Unique id for each department – character – Not Null
   b. **dept_name** – Department Name – Character – Not Null
5. **Department Managers (dept_manager.csv)**
   a. **dept_no** - Unique id for each department – character – Not Null
   b. **emp_no** – Employee number (head of the department) – Integer – Not Null
6. **Department Employees (dept_emp.csv)**
   a. **emp_no** – Employee id – Integer – Not Null
   b. **dept_no** - Unique id for each department – character – Not Null

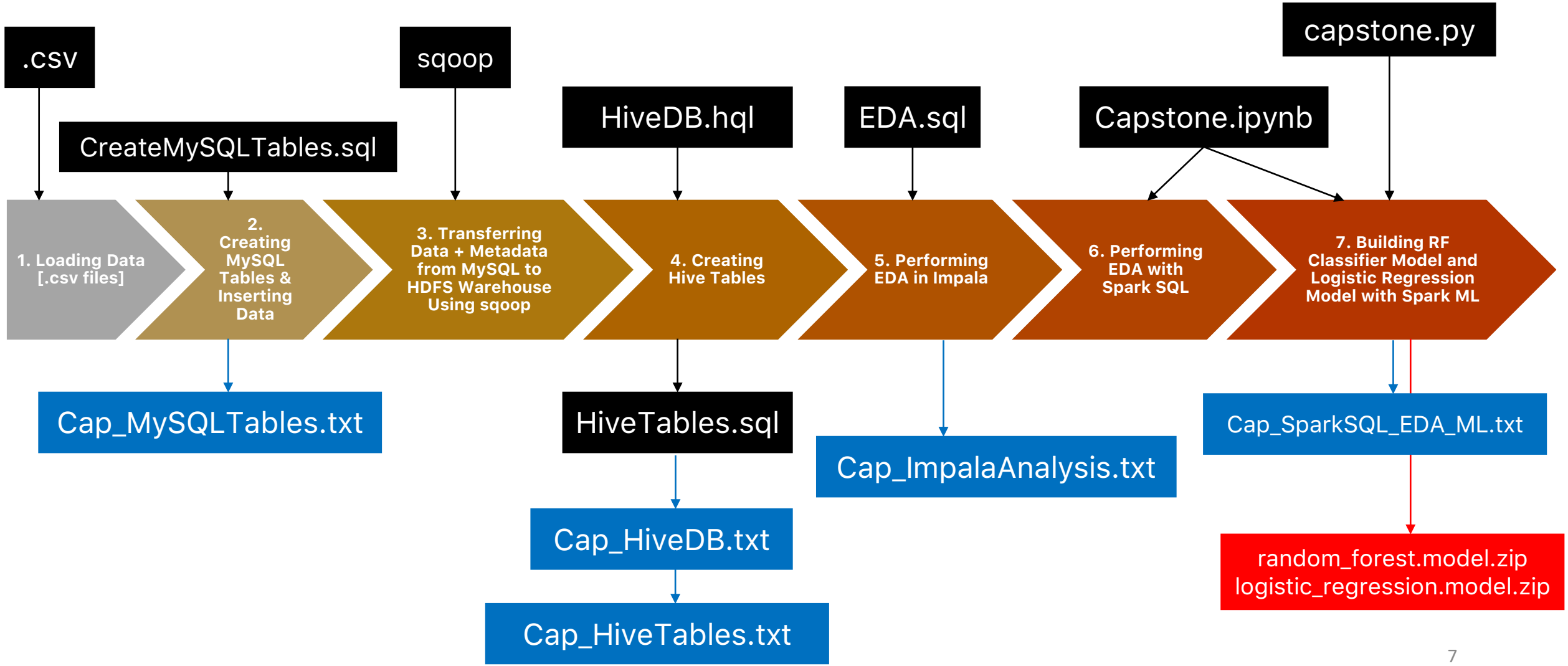
Technology Stack

- Linux Commands (to run .sh file)
- MySQL (to create database - RDBMS)
- Sqoop (Transfer data from MySQL Server to HDFS/Hive)
- HDFS (to store the data)
- Hive (to create database)
- Impala (to perform the EDA)
- SparkSQL & PySpark (to perform the EDA)
- SparkML (to perform model building)

ER Diagram

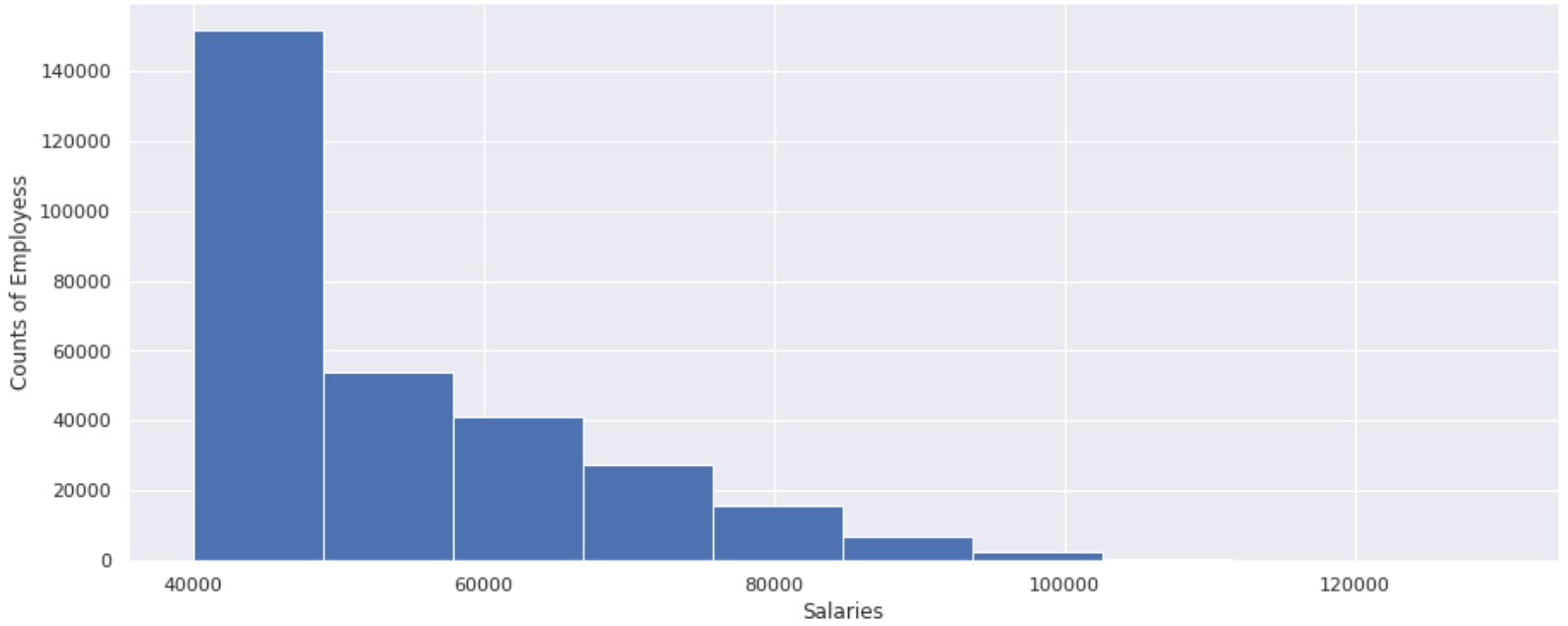

salaries
emp_no INT
salary INT
dept_manager
emp_no INT
dept_no VARCHAR(10)
employees
emp_no INT
emp_title_id VARCHAR(10)
birth_date DATE
first_name VARCHAR(30)
last_name VARCHAR(30)
sex CHAR(1)
hire_date DATE
no_of_projects INT
last_performance_rating VARCHAR(10)
left BIT
last_date DATE
departments
dept_no VARCHAR(10)
dept_name VARCHAR(30)
dept_emp
emp_no INT
dept_no VARCHAR(10)
titles
title_id VARCHAR(10)
title VARCHAR(30)

Architecture of pipeline



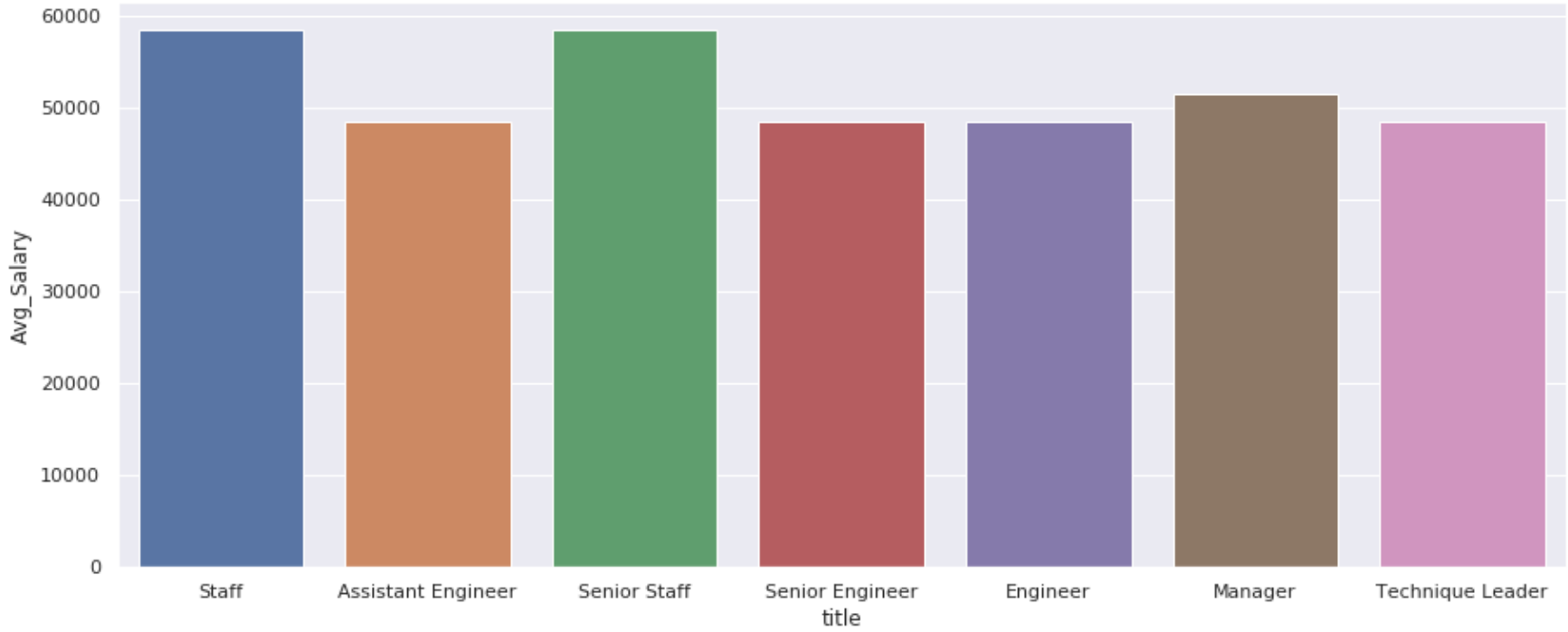
Outputs

- **Histogram to show the salary distribution among the employees**



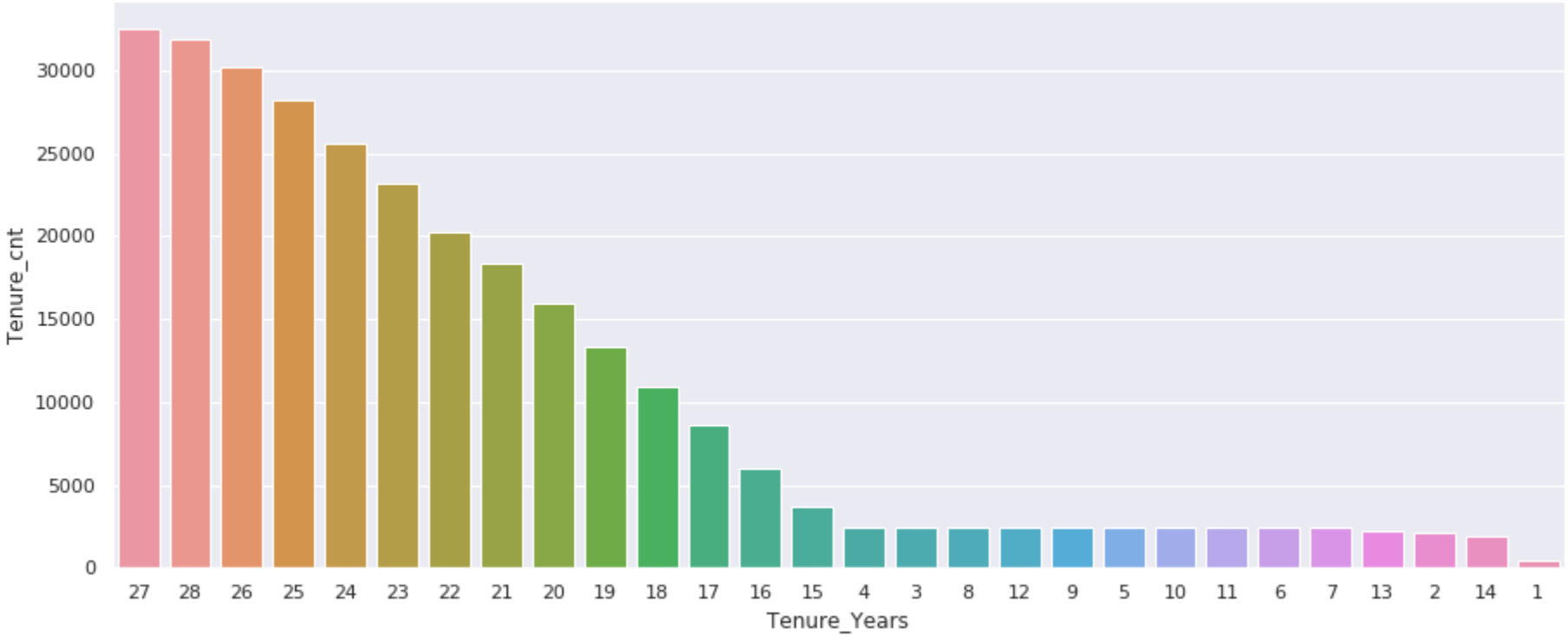
Outputs

- **Bar graph to show the Average salary per title (designation)**



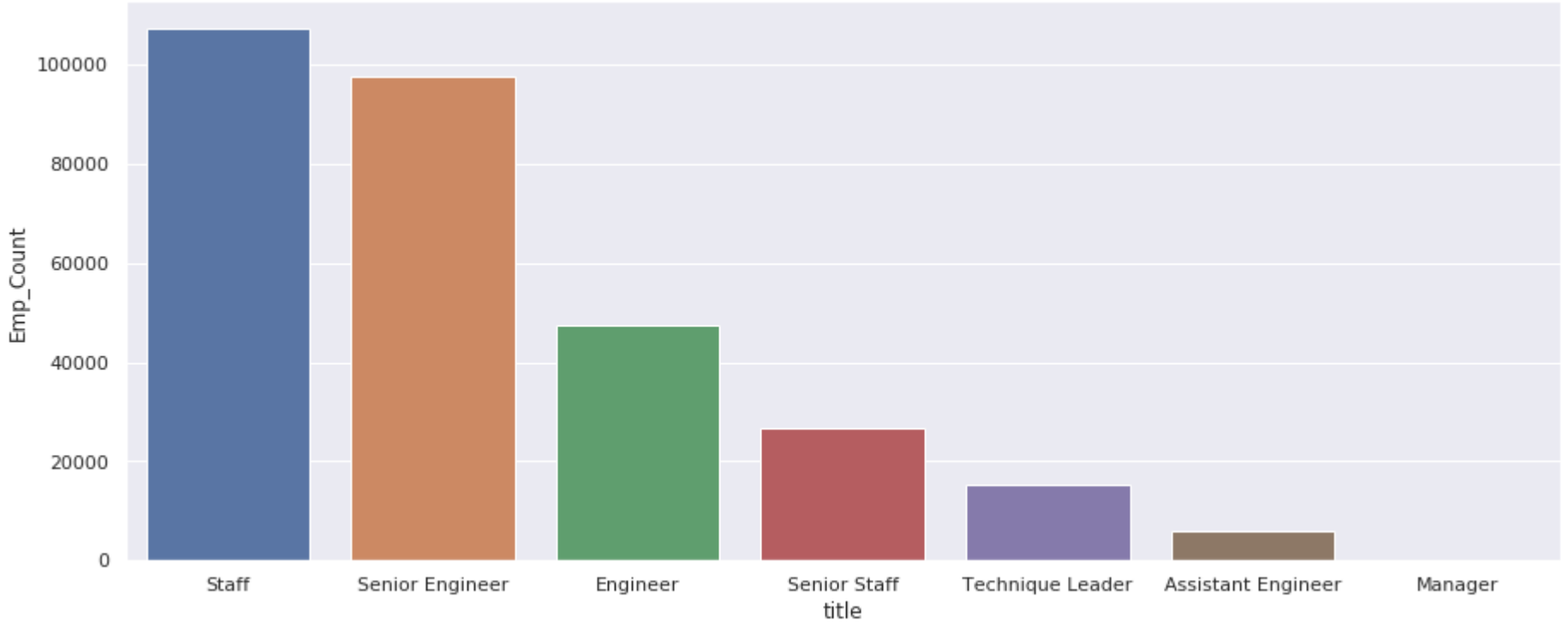
Outputs

- **Calculate employee tenure & show the tenure distribution among the employees**



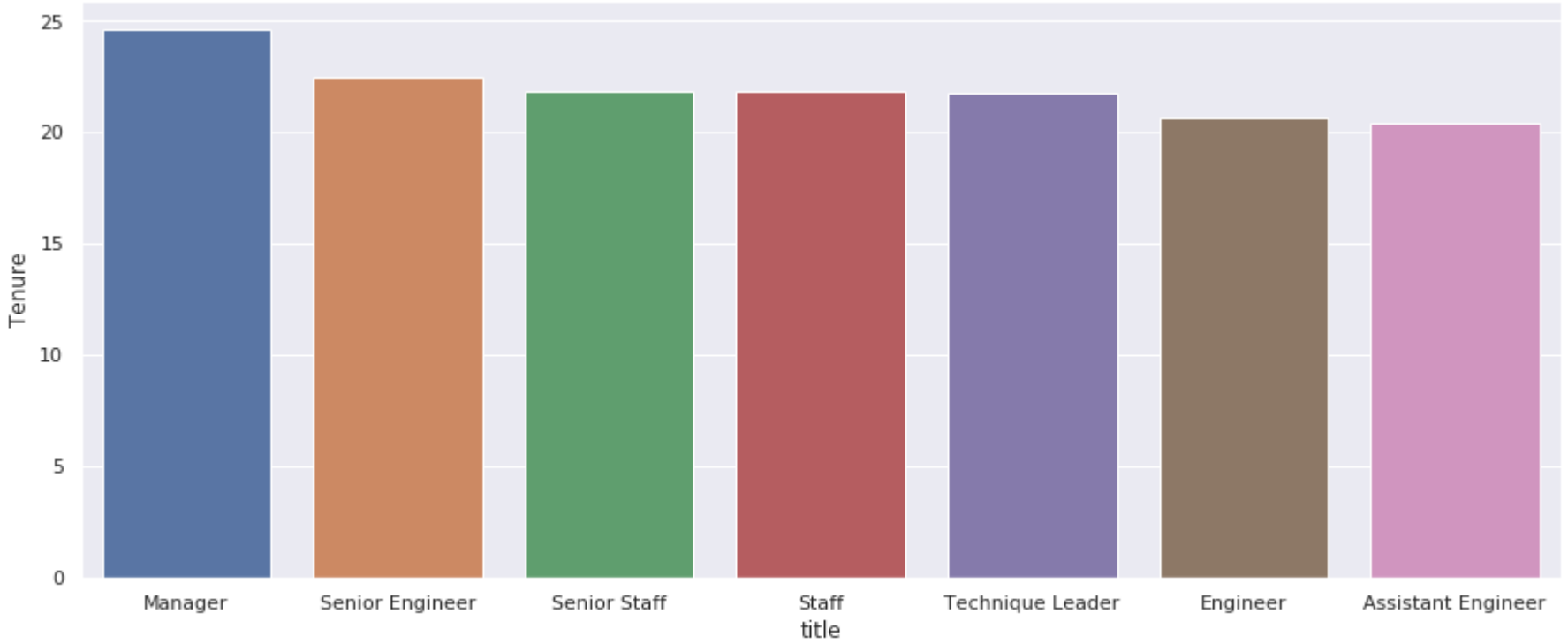
Outputs

- **Distribution of Employees across various titles**



Outputs

- **Average Tenure Distribution across Titles**

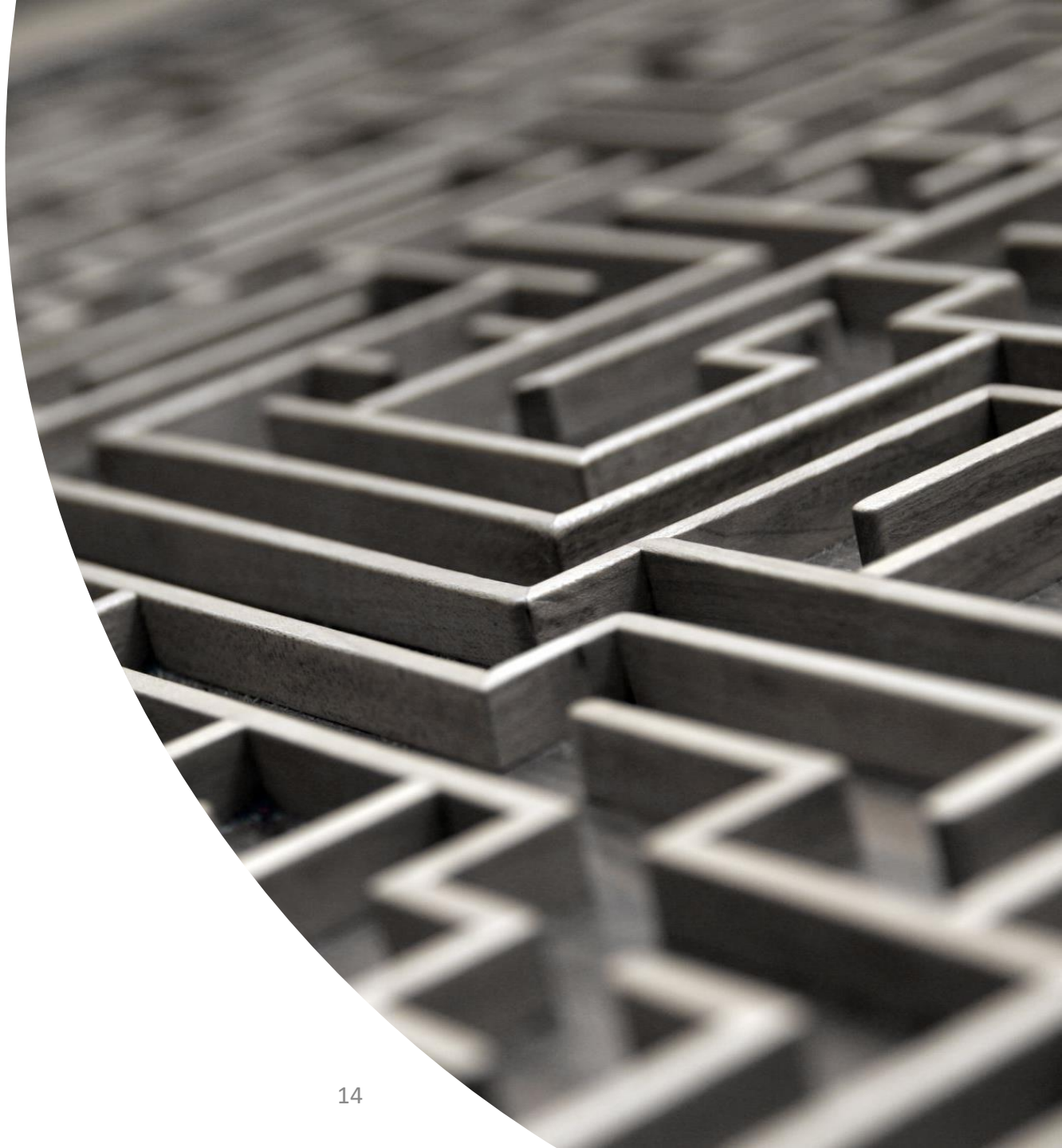


ML Model Parameters

- **Random Forest Classifier Model**
  - Accuracy = 0.9980555834925744
  - Error = 0.0019444165074256606
  - Precision = 0.9980594815941188
  - Recall = 0.9980555834925743
  - F1 = 0.9980471469145747
- **Logistic Regression Model**
  - Accuracy = 0.9004101154357617
  - Error = 0.09958988456423834
  - Precision = 0.8107383759790415
  - Recall = 0.9004101154357617
  - F1 = 0.8532246480840692

Challenges Faced

- Importing data using SQOOP to HDFS (--m 1 argument added)
- Creating the Hive Avro Tables – Merging Data & Metadata
- Fetching the Hive tables in Spark (Jupyter Notebook Environment)
- Creating ML Pipeline as OneHotEncoding does not contain fit method in Spark 2.4.0



Next steps

- Modifying / Upgrading of Working Policies Focusing on the Employee Retention.
- Fixing the Issues related to the Appraisals / Ratings, Salaries etc. so that probability of loosing a valuable employee can be reduced.
- Using the current model further analysis can be done with newly updated employee records to understand employee sentiments.