PROJECT REPORT

on

Target Selection for Mergers and Acquisitions

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ELECTRONICS AND TELECOMMUNICATION ENGINEERING

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CERTIFICATE

This is to certify that the Project Stage-II "**Target Selection for Mergers and Acquisitions**"

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Students of **Electronics and Telecommunication Engineering** have successfully completed their **Project Stage-2** required for the fulfilment of **SEM VIII** as per the norms prescribed by the **University of Mumbai** during the First half of the year 2019. The project synopsis report has been assessed and found satisfactory.

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Internal Guide	**External Guide**
Head of Department	**Principal**
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DECLARATION

We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

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ABSTRACT

The main purpose of this project is to choose targets with good performance if the standard of mergers and acquisition is feasible and reasonable. The analysis of mergers and acquisitions started in the twentieth century. Currently it is observed that more researches are done to understand the long-term performance of the operations of various corporates. The key principle behind M&A is that two companies together are more valuable than two separate companies. This motivation is captivating particularly to companies when times are difficult. Strong companies will act to buy other companies which will give rise to a more competitive, cost-efficient company and, theoretically, more shareholder value. On the other hand, target companies will agree to be taken when they are aware that they are unable to survive alone. The terms merger and acquisition are defined negligibly different but they are often used conversely. If there is an affable financial transaction between two companies then it is called as merger whereas the unfriendly transaction is known as acquisition. M&A is term basically defining the unification of different assets or companies which is done by various financial transactions.

KEYWORDS: Python, Merger and Acquisition, Jupyter Notebook, Google Colabpratory.

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Chapter 1

Introduction

1. INTRODUCTION:

The long-term analysis of merger and acquisition (M&A) is a new avenue of research that started in the last decade of twentieth century. Currently, we can often find more researches devoted to this issue in order to understand the long-term corporate performance of these operations. The key principle behind M&A is that two companies together are more valuable than two separate companies. This rationale is particularly alluring to companies when times are tough. Strong companies will act to buy other companies to create a more competitive, cost-efficient company and, theoretically, more shareholder value. Meanwhile, target companies will often agree to be purchased when they know they cannot survive alone. The terms merger and acquisition mean slightly different things, though they are often used interchangeably. When one company takes over another and clearly establishes itself as the new owner, the purchase is called an acquisition. From a legal point of view, the target company ceases to exist, the buyer absorbs the business and the buyer's stock continues to be traded while the target company's stock does not. In the pure sense of the term, a merger happens when two firms, often of about the same size, agree to go forward as a single new company rather than remain separately owned and operated. This kind of action is more precisely referred to as a "merger of equals." Both companies' stocks are surrendered and new company stock is issued in its place. For example, both Daimler-Benz and Chrysler ceased to exist when the two firms merged, and a new company, Daimler Chrysler, was created. A purchase deal will also be called a merger but when the deal is unfriendly i.e. when the target company does not want to be purchased then it is an acquisition. Whether a purchase is considered a merger or an acquisition really depends on whether the purchase is friendly or hostile and how it is announced. In other words, the real difference lies in how the purchase is communicated to and received by the target company's board of directors, employees and shareholders.[1]

By merging, the companies hope to benefit from the following:

- Staff reductions- As every employee knows, mergers tend to mean job losses. Consider all the money saved from reducing the number of staff members from accounting, marketing and other departments. Job cuts will also include the former CEO, who typically leaves with a compensation package.
- Economies of scale- Yes, size matters. Whether it's purchasing stationery or a new corporate IT system, a bigger company placing the orders can save more on costs. Mergers also translate into improved purchasing power to buy equipment or supplies.

- Acquiring new technology- To stay competitive, companies need to stay on top of technological developments and their business applications.
- Improved market reach and visibility- Companies buy other companies to reach new markets and grow revenues and earnings. A merger may expand two companies' marketing and distribution, giving them new sales opportunities. A merger can also improve a company's standing in the investment community: bigger firms often have an easier time raising capital than smaller ones. Achieving synergy is easier said than done. Achieving synergy takes:
- Planning- How will the combined entity actually go about achieving the synergies touted during the process?
- Preparation and analysis- Ideally planning is done during the M&A due diligence process to ensure that these synergies are real and what it will take to achieve them after the culmination of the transaction.
- Execution- Once the transaction is finalized, critical decisions have to be made. Which operations will be kept or closed? How will you entice key employees to stay? Who will be accountable to see that these synergies are actually realized?[2]

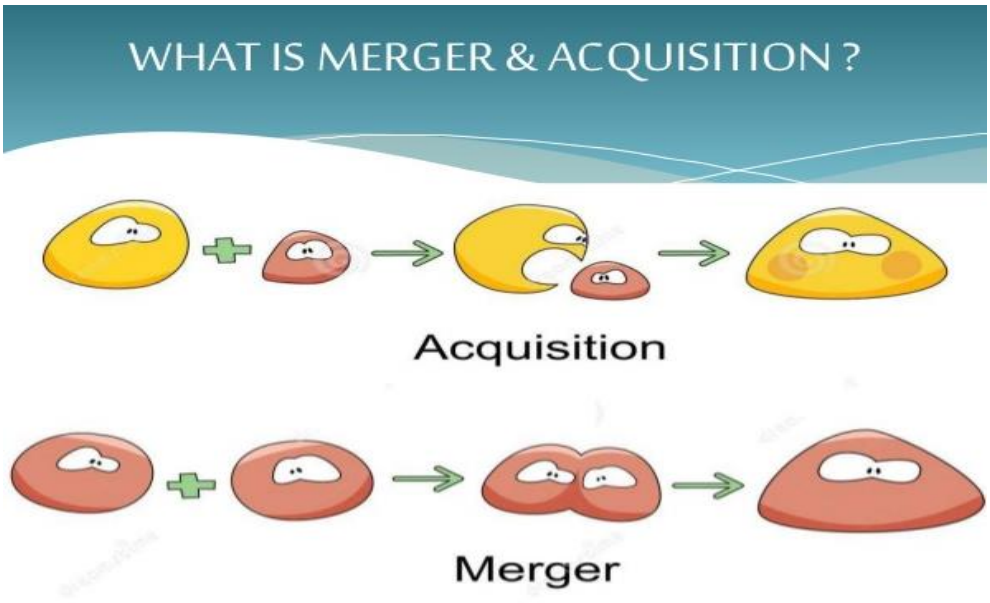


Figure.1- Difference between merger and acquisition.

1.1 FINANCIAL THEORY:

1.1.1) MERGERS

From the perspective of business structures, there is a whole host of different types of mergers. Here are a few types, distinguished by the relationship between the two companies that are merging:

- Horizontal merger - Two companies that are in direct competition and share the same product lines and markets.
- Vertical merger - A customer and company or a supplier and company. Think of a cone supplier merging with an ice cream maker.
- Market-extension merger - Two companies that sell the same products in different markets.
- Product-extension merger - Two companies selling different but related products in the same market.
- Conglomeration - Two companies that have no common business areas.
- Purchase Mergers - As the name suggests, this kind of merger occurs when one company purchases another. The purchase is made with cash or through the issue of some kind of debt instrument; the sale is taxable. Acquired assets can be written-up to the actual purchase price.
- Consolidation Mergers - With this merger, a brand new company is formed and both companies are bought and combined under the new entity. The tax terms are the same as those of a purchase merger.[3]

1.1.2) ACQUISITIONS

An acquisition may be only slightly different from a merger. In fact, it may be different in name only. Like mergers, acquisitions are actions through which companies seek economies of scale, efficiencies and enhanced market visibility. Unlike mergers, all acquisitions involve one firm purchasing another. There is no exchange of stock or consolidation as a new company. Acquisitions are often congenial, and all parties feel satisfied with the deal. Other times, acquisitions are more hostile.

In an acquisition, a company can buy another company with cash, stock or a combination of the two. Another possibility, which is common in smaller deals, is for one company to acquire all the assets of another company. Company X buys all of Company Y's assets for cash, which

means that Company Y will have only cash (and debt, if they had debt before). Of course, Company Y becomes merely a shell and will eventually liquidate or enter another area of business.

Another type of acquisition is a reverse merger, a deal that enables a private company to get publicly-listed in a relatively short time period. A reverse merger occurs when a private company that has strong prospects and is eager to raise financing buys a publicly-listed shell company, usually one with no business and limited assets. The private company reverse merges into the public company, and together they become an entirely new public corporation with tradable shares.

Regardless of their category or structure, all mergers and acquisitions have one common goal: they are all meant to create synergy that makes the value of the combined companies greater than the sum of the two parts. The success of a merger or acquisition depends on whether this synergy is achieved. A proven process for evaluating and executing mergers and acquisitions includes seven essential activities that occur as sequential steps.[4]

1.2 WORKING:

Figure.2- Process of mergers and acquisition.

STEP 1: DETERMINE GROWTH MARKET SERVICES

Leaders start the acquisition evaluation process by identifying growth opportunities in business or service lines, markets served, or any combination thereof. To determine growth markets and services, leaders must collect and analyze extensive data, including the following: client origin; demographics (population, age, employment/unemployment rates, income); employers; other competitors; business, program, and service mix (performance and profitability by service line); field staff; employees; utilization/case mix (demand projections); competitive cost/charge position; and consumer preferences/ opinions.

STEP 2: IDENTIFY MERGER AND ACQUISITION CANDIDATES

The second step of the acquisition process involves the proactive identification of the universe of potential merger or acquisition candidates that could meet strategic financial growth objectives in identified markets or service lines. This involves methodically identifying "likely suspects" as well as "outside the box" possibilities based on management experience, research, the use of consultants, and other methods.

STEP 3: ASSESS STRATEGIC FINANCIAL FIT

At this stage following questions shall be answered:

- What are the likely benefits of a transaction with this acquisition target?
- What are the risks?
- How does this target compare to other targeted opportunities?

STEP 4: FINANCIAL AND CREDIT POSITION

A comprehensive evaluation of the financial and credit position of the target and the combined entities is based on solid utilization and financial forecasts. The assessment focuses on volume, revenue, cost, and balance sheet considerations.

STEP 5: MAKE A GO-NO GO DECISION

Corporate leadership must determine the likely benefits and drawbacks of the proposed acquisition or merger according to the questions discussed earlier and make a high-quality decision. During the decision-making process, leaders identify whether the strategic value-added case for a combined entity is compelling enough to proceed (or not).

STEP 6: CONDUCT VALUATION

The fifth step in the acquisition process involves assessing the value of the target, identifying alternatives for structuring the merger or acquisition transactions, evaluating these, and

selecting the structure that would best enable the organization to achieve its objectives, and developing an offer. There are three key valuation methods: discounted cash flow analysis, comparable transaction analysis, and comparable publicly traded company analysis. To identify a realistic valuation range, corporate leadership should select best suitable method.

STEP 7: PERFORM DUE DILIGENCE

Negotiate a Definitive Agreement, and Execute Transaction. Once an offer on the table is accepted, leaders of the acquiring organization must ensure a complete and comprehensive due diligence review of the target entity in order to fully understand the issues, opportunities, and risks associated with the transaction. Due diligence involves a review of the target's financial, legal, and operational position to ensure an accuracy of information obtained earlier in the acquisition process and full disclosure of all information relevant to the transaction. After due diligence is completed, the parties negotiate definitive agreements. Any regulatory approvals necessary for consummation of the transaction are obtained and the transaction is closed. During transaction execution, the acquirer should monitor the acquisition or merger to ensure that the negotiated transaction continues to meet the goals and objectives established for the transaction at the end of the strategic assessment. Implement Transaction and Monitor Ongoing Performance. The analysis seeks answers to such questions as: Will management make the tough operational changes required to achieve the financial benefits? What are the HR implications? Is there constituent support? What are the legal and regulatory challenges? What are the financial, organizational, and community-related risks of failure? A successful merger or acquisition involves combining two organizations in an expedient manner to maximize strategic value while minimizing distraction or disruption to existing operations. This includes having a ready mechanism to deal with any problem in the implementation of the deal. [5]

1.3 PROJECT RELEVANCE:

Thus, Mergers and acquisitions are the consolidation of companies of the same or different sizes and specialisations for which Analysts at investment banks spend a significant amount of time and effort finding potential targets for these M&As. The exercise involves finding, contacting and filtering potential targets. A simplified version of the process can be defined as setting a criteria of attributes, both qualitative and quantitative which have compelling reasons to consent to acquisition as well as show prospects for profits in the future. The suitability for targets can be ascertained using several means. A variety of financial ratios, qualitative metrics,

etc. are used. Merger and acquisitions are conventionally carried out by financial experts after detailed study. The project aims to digitize the initial process by incorporating the financial attributes of a target into the self-learning capacity of neural nets. It builds on the transition of human input taken as fuzzy input which in turn translates into learning of neural nets. The project will show that there are evident and identified financial characteristics of targets of M&A. It seeks to prove that algorithms can be used as an effective tool to cluster data. It explores and reviews the ability of different algorithms to identify targets for mergers and acquisitions, thereby seeking to eliminate the need for preliminary target search efforts, allowing investment banks to focus, instead, on activities such as targeted due diligence, valuation and negotiations. The process of learning the deep story of a company which is considered to be target can be performed by using a rough framework which outlines the specifics variables that are crucial in determining suitability of the company as well its general financial and non-financial health. Financial factors include size, profitability, growth profile, return on investment, credit profile, etc. Factors that reflect the business profile of a company include sector, products and services, customers, geography, etc. Once a target's basic financial and business characteristics are researched, the initial focus is maintained at identifying targets that have similar business profiles. All this information can be derived from various publicly available documents such as SEC Filings, 10-K i.e. annual report, 10- Q i.e. quarterly report, 8-K i.e. current report, etc. We explore the computational means that supplant the physical efforts outlined above. Computationally, relevant data must be fed to the algorithm. It can be in the form of textual data of patents or financial ratios chosen to be the most accurate depiction of the attributes and performance of the target companies. To get a comprehensive valuation of firms with mergers and acquisitions activity, we include eight financial fundamental ratios as measurement and controls in the models. [6]

1.4 INPUT RATIOS:

1.4.1) SALES GROWTH

Sales growth shows the increase in sales over a specific period of time - this is important because as an investor, you want to know that the demand for a company's products or services will be increasing in the future. Growth rates differ by industry and company size. Sales growth of 5-10% is usually considered good for large-cap companies, while for mid-cap and small-cap companies, sales growth of over 10% is more achievable. The amount a company derives from

sales compared to a previous, corresponding period of time in which the latter sales exceed the former. For example, a company has experienced sales growth when its sales were $1 million in Q1 2009 and are $1.2 million in Q1 2010. Sales growth is considered positive for a company's survival and profitability.

There are five specific strategies you can deploy to grow sales now:

- Increase Penetration in Existing Markets: Stick to your knitting and grow market share in what you do best already.
- New Products Line Extensions: The second most popular strategy to grow sales is to extend the product line to a new complementary product that existing clients would be pleased you now offer.
- New Client Segments: Focusing on new client segments will power strong growth. Observe and identify other activities your client is buying from others that you could make for them.
- New Channels of Distribution: Assertively opening up new channels of distribution will increase sales. It will strengthen your brand and make your firm more impervious to the ups and downs of your existing channels.
- New Services: Offer new services to your clients so they become more enamored with your firm. So, you are more "sticky" and harder to leave. Make sure the services are profitable. [7]

1.4.2) PAT GROWTH

PAT stands for profit after tax. Same as individuals corporate are also eligible for paying tax if there earning is more than the cost.

So for a business earning is equals to the amount they gather after providing the service. This comes as Revenue, while running a business you have various expenses, cost of raw materials and overheads i.e. employee salary, electricity bill and others that would be now deducted from revenue which will comes as EBITDA also known as Earning before Interest, Tax, Depreciation and Amortization. And after incurring all the charges is EBITDA the amount left is termed as pure profit also known as Profit After Tax. Increase or decrease in PAT or PAT margin (=PAT/Total revenue) shows whether the company is doing good or not. [7]

1.4.3) RETURN ON CAPITAL EMPLOYED

Return on capital employed (ROCE) is a financial ratio that measures a company's profitability and the efficiency with which its capital is employed. ROCE is calculated as:

ROCE = Earnings Before Interest and Tax (EBIT) / Capital Employed

ROCE is a useful metric for comparing profitability across companies based on the amount of capital they use. There are two metrics required to calculate the Return on Capital Employed - earnings before interest and tax and capital employed. Earnings before interest and tax (EBIT), also known as operating income, shows how much a company earns from its operations alone without regard to interest or taxes. EBIT is calculated by subtracting cost of goods sold and operating expenses from revenues. Capital employed is the total amount of capital that a company has utilized in order to generate profits. It is the sum of shareholders' equity and debt liabilities. Also, it can be simplified as total assets minus current liabilities. Instead of using capital employed at an arbitrary point in time, analysts and investors often calculate ROCE based on the average capital employed, which takes the average of opening and closing capital employed for the time period. ROCE is especially useful when comparing the performance of companies in capital-intensive sectors such as utilities and telecoms. A company may occasionally have an inordinate amount of cash on hand, but since such cash is not actively employed in the business, it may need to be subtracted from the Capital Employed figure to get a more accurate measure of ROCE. For a company, the ROCE trend over the years is also an important indicator of performance. [8]

1.4.4) TOTAL ASSETS

The final amount of all gross investments, cash and equivalents, receivables and other assets as they are presented on the obtained balance sheet.
Total assets refers to the total amount of assets owned by a person or entity. Assets are items of economic value, which are expended over time to yield a benefit for the owner. If the owner is a business, these assets are usually recorded in the accounting records and appear in the balance sheet of the business. Typical categories in which these assets may be found includes cash, marketable securities, accounts receivable, prepaid expenses, inventory, fixed assets, intangible assets or goodwill. Depending on the applicable accounting standards, the assets that comprise the total assets category may or may not be recorded at their current market values. In general, international financial reporting standards are more amenable to stating assets at

their current market values, while generally accepted accounting principles are less likely to allow such a restatement. Owners may look at their total assets in regard to which can be converted most quickly into cash. An asset is said to be more liquid if it can be readily sold for cash, and illiquid if this is not the case. The liquidity concept is also used for the presentation of assets within the balance sheet, with the most liquid items (such as cash) listed at the top and the least liquid (such as fixed assets) listed closer to the bottom. This order of liquidity appears in the preceding bullet point list of assets.

Assets are also classified on the balance sheet as either current assets or long-term assets. A current asset, such as an account receivable or marketable security, is expected to be liquidated within one year. A long-term asset, such as a fixed asset, is expected to be liquidated in more than one year.

A potential acquirer will pay particular attention to the various types of assets listed on the balance sheet of a target company. The emphasis will be on judging whether the asset value stated on the balance sheet corresponds to the actual value of an asset, or if there are significant differences. If the actual value is lower, the acquirer will likely reduce the size of its bid. If an asset has a higher value, the acquirer will have greater interest in acquiring the business, and so may increase its offer price. [8]

1.4.5) DEBT EQUITY RATIO

The debt-to-equity (D/E) ratio is calculated by dividing a company's total liabilities by its shareholder equity. These numbers are available on the balance sheet of a company's financial statements.

The ratio is used to evaluate a company's financial leverage. The D/E ratio is an important metric used in corporate finance. It is a measure of the degree to which a company is financing its operations through debt versus wholly owned funds. More specifically, it reflects the ability of shareholder equity to cover all outstanding debts in the event of a business downturn.

Debt/Equity= Total liabilities/ Total Shareholders' equity

Given that the debt-to-equity ratio measures a company's debt relative to the value of its net assets, it is most often used to gauge the extent to which a company is taking on debt as a means

of leveraging its assets. A high debt/equity ratio is often associated with high risk; it means that a company has been aggressive in financing its growth with debt.

If a lot of debt is used to finance growth, a company could potentially generate more earnings than it would have without that financing. If leverage increases earnings by a greater amount than the debt's cost (interest), then shareholders should expect to benefit. However, if the cost of debt financing outweighs the increased income generated, share values may decline. The cost of debt can vary with market conditions. Thus, unprofitable borrowing may not be apparent at first.

Changes in long-term debt and assets tend to have the greatest impact on the D/E ratio because they tend to be larger accounts compared to short-term debt and short-term assets. If investors want to evaluate a company's short-term leverage and its ability to meet debt obligations that must be paid over a year or less, other ratios will be used.

- The debt-to-equity (D/E) ratio compares a company's total liabilities to its shareholder equity. Investors can use the D/E ratio to evaluate how much leverage a company is using.
- Higher leverage ratios tend to indicate a company or stock with higher risk to shareholders.
- However, the D/E ratio is difficult to compare across industry groups where ideal amounts of debt will vary.
- Investors will often modify the D/E ratio to focus on long-term debt only because the risk of long-term liabilities are different than for short-term debt and payables. [8]

Chapter 2

Tools used

2. TOOLS USED:

2.1 PYTHON:

Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms. It bears some similarities to Fortran, one of the earliest programming languages, but it is much more powerful than Fortran. Python allows you to use variables without declaring them (i.e., it determines types implicitly), and it relies on indentation as a control structure. You are not forced to define classes in Python (unlike Java) but you are free to do so when convenient. Python was developed by Guido van Rossum, and it is free software. Free as in "free beer," in that you can obtain Python without spending any money. But Python is also free in other important ways, for example you are free to copy it as many times as you like, and free to study the source code, and make changes to it. There is a worldwide movement behind the idea of free software, initiated in 1983 by Richard Stallman.

Some specific features of Python are as follows:

- An interpreted (as opposed to compiled) language. Contrary to e.g. C or Fortran, one does not compile Python code before executing it. In addition, Python can be used interactively: many Python interpreters are available, from which commands and scripts can be executed.
- A free software released under an open-source license: Python can be used and distributed free of charge, even for building commercial software.
- Multi-platform: Python is available for all major operating systems, Windows, Linux/Unix, MacOS X, most likely your mobile phone OS, etc.
- A readable language with clear non-verbose syntax.
- A language for which a large variety of high-quality packages are available for various applications, from web frameworks to scientific computing.
- A language very easy to interface with other languages, in particular C and C++.
- Some other features of the language are illustrated just below. For example, Python is an object-oriented language, with dynamic typing (the same variable can contain objects of different types during the course of a program). [9]

2.2 JUPYTER NOTEBOOK:

The Jupyter Notebook is an interactive computing environment that enables users to author notebook documents that include live code, interactive widgets, plots, narrative text, etc. These documents provide a complete and self-contained record of a computation that can be converted to various formats and shared with others using email, Dropbox. Jupyter Notebooks are powerful, versatile and shareable and provide the ability to perform data visualization in the same environment.

Jupyter Notebook is an open-source web application that allows us to create and share codes and documents. It provides an environment, where you can document your code, run it, look at the outcome, visualize data and see the results without leaving the environment. This makes it a handy tool for performing end to end data science workflows – data cleaning, statistical modeling, building and training machine learning models, visualizing data and other uses.

Jupyter Notebooks really shine when you are still in the prototyping phase. This is because your code is written in independent cells, which are executed individually. This allows the user to test a specific block of code in a project without having to execute the code from the start of the script. Many other IDE environments also do this but Jupyter's individual cells structure to be the best of the lot. These Notebooks are incredibly flexible, interactive and powerful tools in the hands of a data scientist. They even allow you to run other languages like R, SQL, etc. Since they are more interactive than an IDE platform, they are widely used to display codes in a more pedagogical manner. The Jupyter Notebook combines three components:

- The notebook web application**:** An interactive web application for writing and running code interactively and authoring notebook documents.
- Kernels: Separate processes started by the notebook web application that runs users' code in a given language and returns output back to the notebook web application. The kernel also handles things like computations for interactive widgets, tab completion and introspection.
- Notebook documents: Self-contained documents that contain a representation of all content visible in the notebook web application, including inputs and outputs.

Jupyter Notebook installation can be done as follows but before that one need to have Python installed on his machine first. There must be either Python 2.7 or Python 3.3 (or greater).

- Anaconda- For new users, the general consensus is that you should use the Anaconda distribution to install both Python and the Jupyter notebook. Anaconda installs both these tools and includes quite a lot of packages commonly used in the data science and machine learning community.

- The pip method- If, for some reason, you decide not to use Anaconda, then you need to ensure that your machine is running the latest pip version. The upgradation to latest version is also possible by writing pip command line code.

2.3 GOOGLE COLABORATORY:

Data science is nothing without data. Yes, that's obvious. What is not so obvious is the series of steps involved in getting the data into a format which allows you to explore the data. You may be in possession of a dataset in CSV format (short for comma-separated values) but no idea what to do next with this data. Colab (short for Colaboratory) is a free platform from Google that allows users to code in Python. Colab is essentially the Google Suite version of a Jupyter Notebook. Some of the advantages of Colab over Jupyter include an easier installation of packages and sharing of documents. Yet, when loading CSV files, it requires extra coding.

To upload from your local drive, start with the following code:

```
from google.colab import files

uploaded = files.upload()
```

It will prompt you to select a file. Click on "Choose Files" then select and upload the file. You should see the name of the file once Colab has uploaded it. Finally, type in the following code to import it into a dataframe (make sure the filename matches the name of the uploaded file).

```
import io
df2 = pd.read_csv(io.BytesIO(uploaded['Filename.csv']))
```

2.4 SCIENTIFIC PYTHON PACKAGES:

Beyond Python there are a number of open source libraries generally used to facilitate practical machine learning. In general, these are the main so-called scientific python libraries we put to use when performing elementary machine learning tasks. Some examples are:

2.4.1) PANDAS LIBRARY

pandas is a Python package providing fast, flexible, and expressive data structures designed to make working with “relational” or “labeled” data both easy and intuitive. pandas is well suited for many different kinds of data as follows:

- Tabular data with heterogeneously-typed columns e.g. SQL table or Excel spreadsheet.
- Ordered and unordered (not necessarily fixed-frequency) time series data.
- Arbitrary matrix data (homogeneously typed or heterogeneous) with row and column labels.
- Any other form of observational /statistical data sets. The data actually need not be labeled at all to be placed into a pandas data structure.
- The two primary data structures of pandas, Series (1-dimensional) and DataFrame (2-dimensional), handle the vast majority of typical use cases in finance, statistics, etc.

Here are a few of the things which are features of pandas:

- Size mutability: columns can be inserted and deleted from DataFrame and higher dimensional objects.
- Automatic and explicit data alignment: objects can be explicitly aligned to a set of labels, or the user can simply ignore the labels and let Series, DataFrame, etc. automatically align the data for you in computations.
- Powerful group by functionality to perform split-apply-combine operations on data.
- Make it easy to convert ragged, differently-indexed data in other Python and NumPy data structures into DataFrame objects.
- Intelligent label-based slicing, fancy indexing, and subsetting of large data sets
- Intuitive merging and joining data sets.
- Hierarchical labeling of axes (possible to have multiple labels per tick).
- Robust IO tools for loading data from flat files (CSV and delimited), Excel files, etc.

2.4.2) SCIKIT-LEARN LIBRARY

Sklearn is a machine learning python library that is widely used for data-science related tasks. It features various classification, regression and clustering algorithms including support vector machines, random forests, gradient boosting, k-means, KNN, etc.

The sklearn.preprocessing package provides several common utility functions and transformer classes to change raw feature vectors into a representation that is more suitable for the downstream estimators. In general, learning algorithms benefit from standardization of the data set. If some outliers are present in the set, robust scalers or transformers are more appropriate. The scaling features to lie between a given minimum and maximum value, often between zero and one, or so that the maximum absolute value of each feature is scaled to unit size. This can be achieved using MinMaxScaler or MaxAbsScaler, respectively. The motivation to use this scaling include robustness to very small standard deviations of features and preserving zero entries in sparse data.
If MinMaxScaler is given an explicit feature_range = (min, max) the full formula is:

X_std = (X - X.min(axis=0)) / (X.max(axis=0) - X.min(axis=0))

X_scaled = X_std * (max - min) + min

2.4.3) MATPLOTLIB LIBRARY

Matplotlib is a Python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms. Matplotlib can be used in Python scripts, the Python and IPython shells, the Jupyter notebook, web application servers, and four graphical user interface toolkits.

Matplotlib tries to make easy things easy and hard things possible. You can generate plots, histograms, power spectra, bar charts, errorcharts, scatterplots, etc., with just a few lines of code. For examples, see the sample plots and thumbnail gallery.

For simple plotting the pyplot module provides a MATLAB-like interface, particularly when combined with IPython. For the power user, you have full control of line styles, font properties, axes properties, etc, via an object oriented interface or via a set of functions familiar to MATLAB users.

matplotlib.cm: Here, cm stands for colormap. The built-in colormaps, colormap handling utilities, and the ScalarMappable mixin is provided by this command. [9]

2.5 MACHINE LEARNING ALGORITHMS:

2.5.1) SUPERVISED LEARNING

This algorithm consist of a target / outcome variable (or dependent variable) which is to be predicted from a given set of predictors (independent variables). Using these set of variables, we generate a function that map inputs to desired outputs. The training process continues until the model achieves a desired level of accuracy on the training data.

Examples of Supervised Learning: Regression, Decision Tree, Random Forest, KNN, Logistic Regression etc.

2.5.2) UNSUPERVISED LEARNING

In this algorithm, we do not have any target or outcome variable to predict / estimate. It is used for clustering population in different groups, which is widely used for segmenting customers in different groups for specific intervention.

Examples of Unsupervised Learning: Apriori algorithm, K-means.

2.5.3) REINFORCEMENT LEARNING

Using this algorithm, the machine is trained to make specific decisions. It works this way: the machine is exposed to an environment where it trains itself continually using trial and error. This machine learns from past experience and tries to capture the best possible knowledge to make accurate business decisions.

Example of Reinforcement Learning: Markov Decision Process

In this project we will use different supervised learning algorithms because our dataset have target output. [10]

Chapter 3

Theory

3. THEORY:

Artificial neural networks (ANNs) are computing systems inspired by the biological neural networks that constitute animal brains. Such systems "learn" (i.e. progressively improve performance on) tasks by considering examples, generally without task-specific programming. An ANN is based on a collection of connected units called artificial neurons (a simplified version of biological neurons in an animal brain). Each connection (a simplified version of a synapse) between artificial neurons can transmit a signal from one to another. The artificial neuron that receives the signal can process it and then signal artificial neurons connected to it. Normally, ANN implements the signal at a connection between artificial neurons is a real number, and the output of each artificial neuron is calculated by a non-linear function of the sum of its inputs. Artificial neurons and connections typically have a weight that adjusts as learning proceeds. The weight increases or decreases the strength of the signal at a connection. Neurons may have a threshold such that only if the aggregate signal crosses that threshold is the signal sent. Typically, artificial neurons are organized in layers. Different layers perform different kinds of transformations on their inputs. Signals travel from the first (input), to the last (output) layer, possibly after traversing the layers multiple times. The ANN approach is focused on matching specific tasks. ANNs have been used for computer vision, speech recognition, machine translation, social network filtering and medical diagnosis. [11]

The machine learning algorithms used are applied to identify targets according to acquirers' or investors' standard. The dataset prepared from past values of input financial parameters are considered as the input. The input vector given to the neural network i.e. the parameters on the basis of which the companies will be sifted are – Sales growth, PAT growth, return on capital employed, total assets and debt equity ratio. This method uses financial parameters of the target companies as the input vectors. During the training, the output neurons are ordered by adjusting their weight vectors in order to approximate the probability density of the input data. Although the initial weight vectors of the output neurons are random, in the long run, these weight vectors converge to a certain value that tends to approximate the distribution of the input data. When the train epochs are 1000, the distribution of weight is stable and unchangeable. Result- clusters are formed known as "sorts", which give characteristics of targets and non-targets. The activation function will decide whether the company is target or a non-target. The sigmoidal activation function gives output as binary i.e. 0 or 1. [12]

Figure.3- Neural network for example for binary classification.

3.1 LOGISTIC REGRESSION ALGORITHM:

Logistic Regression is a Machine Learning classification algorithm that is used to predict the probability of a categorical dependent variable. Logistic Regression is one of the most simple and commonly used algorithm for two-class classification. It is easy to implement and can be used as the baseline for any binary classification problem. Its basic fundamental concepts are also constructive in deep learning. Logistic regression describes and estimates the relationship between one dependent binary variable and independent variables. In logistic regression, the dependent variable is a binary variable that contains data coded as 1 (yes, success, etc.) or 0 (no, failure, etc.). In other words, the logistic regression model predicts P(Y=1) as a function of X.

Logistic Regression Assumptions

- Binary logistic regression requires the dependent variable to be binary.
- For a binary regression, the factor level 1 of the dependent variable should represent the desired outcome.
- Only the meaningful variables should be included.
- The independent variables should be independent of each other. That is, the model should have little or no multicollinearity.
- The independent variables are linearly related to the log odds.
- Logistic regression requires quite large sample sizes.[13]

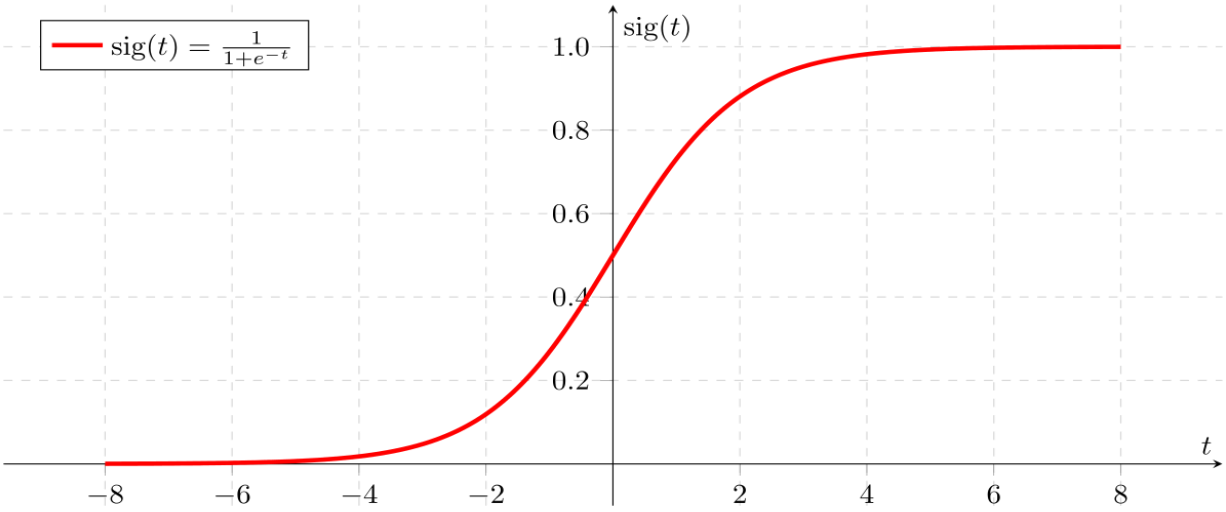


Figure.4- Logistic regression model transfer characteristics.

3.2 DECISION TREE ALGORITHM:

Decision tree is the most powerful and popular tool for classification and prediction. A Decision tree is a flowchart like tree structure, where each internal node denotes a test on an attribute, each branch represents an outcome of the test, and each leaf node holds a class label.

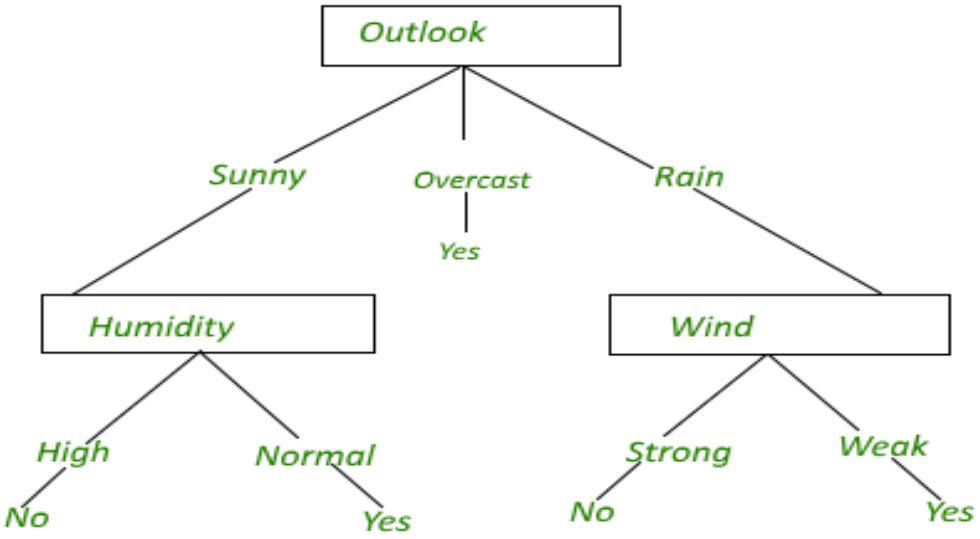


Figure.5- Decision tree example.

Construction of Decision Tree:

A tree can be "learned" by splitting the source set into subsets based on an attribute value test. This process is repeated on each derived subset in a recursive manner called recursive partitioning. The recursion is completed when the subset at a node all has the same value of the target variable, or when splitting no longer adds value to the predictions. The construction of decision tree classifier does not require any domain knowledge or parameter setting, and therefore is appropriate for exploratory knowledge discovery. Decision trees can handle high dimensional data. In general decision tree classifier has good accuracy.

The strengths of decision tree methods are:

- Decision trees are able to generate understandable rules.
- Decision trees perform classification without requiring much computation.
- Decision trees are able to handle both continuous and categorical variables.
- Decision trees provide a clear indication of which fields are most important for prediction or classification.

The weaknesses of decision tree methods:

- Decision trees are less appropriate for estimation tasks where the goal is to predict the value of a continuous attribute.
- Decision trees are prone to errors in classification problems with many class and relatively small number of training examples.
- Decision tree can be computationally expensive to train. The process of growing a decision tree is computationally expensive. At each node, each candidate splitting field must be sorted before its best split can be found. In some algorithms, combinations of fields are used and a search must be made for optimal combining weights. Pruning algorithms can also be expensive since many candidate sub-trees must be formed and compared.[14]

3.3 K-NEAREST NEIGHBORS ALGORITHM (K-NN):

In pattern recognition, the k-nearest neighbors algorithm (k-NN) is a non-parametric method used for classification and regression. In both cases, the input consists of the k closest training examples in the feature space. The output depends on whether k-NN is used for classification or regression:

In k-NN classification, the output is a class membership. An object is classified by a plurality vote of its neighbors, with the object being assigned to the class most common among its k

nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is simply assigned to the class of that single nearest neighbor.

In k-NN regression, the output is the property value for the object. This value is the average of the values of k nearest neighbors.

k-NN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification. The k-NN algorithm is among the simplest of all machine learning algorithms.

Both for classification and regression, a useful technique can be used to assign weight to the contributions of the neighbors, so that the nearer neighbors contribute more to the average than the more distant ones. For example, a common weighting scheme consists in giving each neighbor a weight of 1/d, where d is the distance to the neighbour.

The neighbors are taken from a set of objects for which the class (for k-NN classification) or the object property value (for k-NN regression) is known. This can be thought of as the training set for the algorithm, though no explicit training step is required.

A peculiarity of the k-NN algorithm is that it is sensitive to the local structure of the data. [15]

Algorithm:

The training examples are vectors in a multidimensional feature space, each with a class label. The training phase of the algorithm consists only of storing the feature vectors and class labels of the training samples.

In the classification phase, k is a user-defined constant, and an unlabelled vector (a query or test point) is classified by assigning the label which is most frequent among the k training samples nearest to that query point.

A commonly used distance metric for continuous variables is Euclidean distance. For discrete variables, such as for text classification, another metric can be used, such as the overlap metric (or Hamming distance). In the context of gene expression microarray data, for example, k-NN has been employed with correlation coefficients, such as Pearson and Spearman, as a metric. Often, the classification accuracy of k-NN can be improved significantly if the distance metric is learned with specialized algorithms such as Large Margin Nearest Neighbor or Neighbourhood components analysis.

For example, in a self-organizing map (SOM), each node is a representative (a center) of a cluster of similar points, regardless of their density in the original training data. K-NN can then be applied to the SOM. [16]

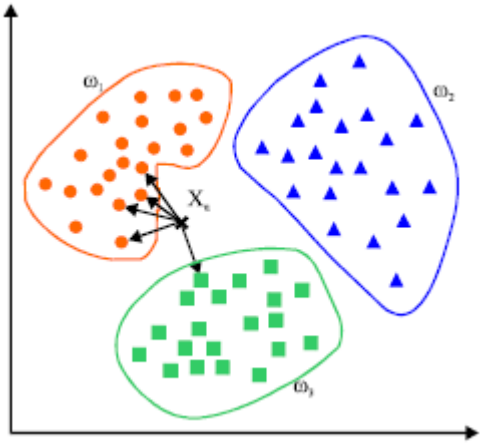


Figure.6- k- nearest neighor algorithm classification.

3.4 NAIVE BAYES CLASSIFIER:

In machine learning, naive Bayes classifiers are a family of simple "probabilistic classifiers" based on applying Bayes' theorem with strong (naive) independence assumptions between the features.

Naive Bayes has been studied extensively since the 1960s. It was introduced (though not under that name) into the text retrieval community in the early 1960s, and remains a popular (baseline) method for text categorization, the problem of judging documents as belonging to one category or the other (such as spam or legitimate, sports or politics, etc.) with word frequencies as the features. With appropriate pre-processing, it is competitive in this domain with more advanced methods including support vector machines. It also finds application in automatic medical diagnosis.

Naive Bayes classifiers are highly scalable, requiring a number of parameters linear in the number of variables (features/predictors) in a learning problem. Maximum-likelihood training can be done by evaluating a closed-form expression, which takes linear time, rather than by expensive iterative approximation as used for many other types of classifiers.

In the statistics and computer science literature, naive Bayes models are known under a variety of names, including simple Bayes and independence Bayes. All these names reference the use of Bayes' theorem in the classifier's decision rule, but naive Bayes is not (necessarily) a Bayesian method.[17][18]

3.5 SUPPORT-VECTOR MACHINE (SVM):

In machine learning, support-vector machines (SVMs, also support-vector networks) are supervised learning models with associated learning algorithms that analyse data used for classification and regression analysis. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary linear classifier (although methods such as Platt scaling exist to use SVM in a probabilistic classification setting). A SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall.

In addition to performing linear classification, SVMs can efficiently perform a non-linear classification using what is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces.

When data is unlabelled, supervised learning is not possible, and an unsupervised learning approach is required, which attempts to find natural clustering of the data to groups, and then map new data to these formed groups. The support-vector clustering algorithm, created by Hava Siegelmann and Vladimir Vapnik, applies the statistics of support vectors, developed in the support vector machines algorithm, to categorize unlabeled data, and is one of the most widely used clustering algorithms in industrial applications.[19]

Chapter 4

Implementation

4.1 BLOCK DIAGRAM:

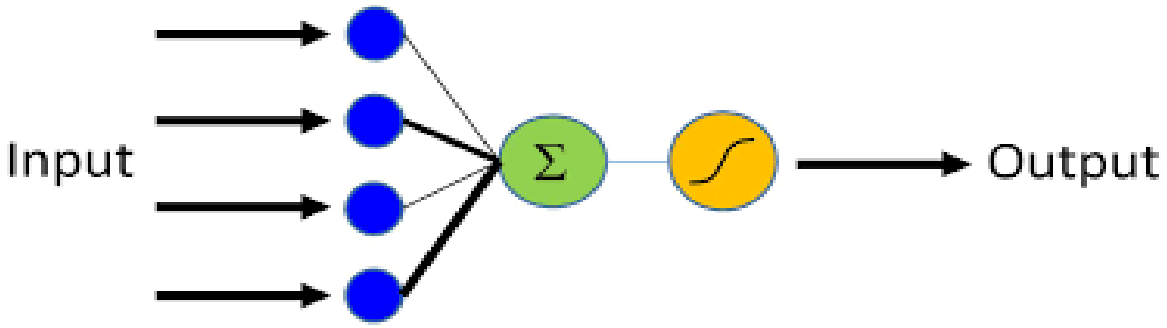
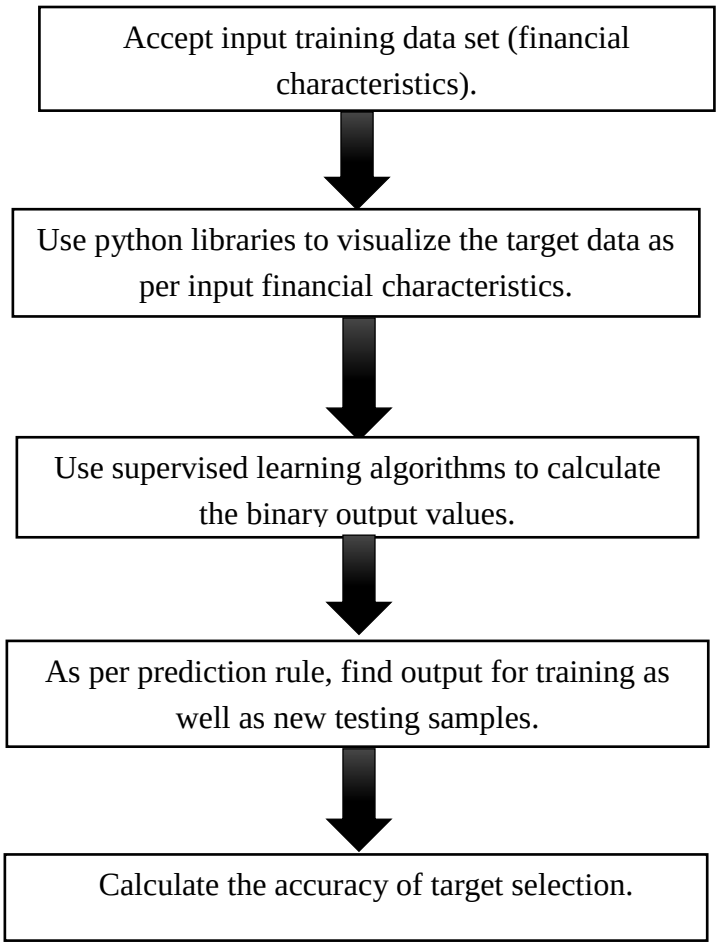


Figure.7-Structure of Neural Network having sigmoid activation function for predictions.

4.1 FLOWCHART:



Chapter 5

Software implementation

5.1 SOFTWARE PYTHON CODE:

```
import pandas as pd
rock = pd.read_csv("book.csv")
rock.head()
from pandas.tools.plotting import scatter matrix
from matplotlib import cm
feature_names = ['SG', 'PATG', 'ROCE', 'TA','DER']
X = rock[feature_names]
Y = rock['Output ']
```

#Creating train & test samples

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=0)
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

#Logistic Regression

```
from sklearn.linear_model import LogisticRegression
logreg = LogisticRegression()
logreg.fit(X_train, y_train)
print('Accuracy of Logistic regression classifier on training set: {:.2f}'
    .format(logreg.score(X_train, y_train)))
print('Accuracy of Logistic regression classifier on test set: {:.2f}'
```

```
    .format(logreg.score(X_test, y_test)))

#Decision Trees
from sklearn.tree import DecisionTreeClassifier
clf = DecisionTreeClassifier().fit(X_train, y_train)
print('Accuracy of Decision Tree classifier on training set: {:.2f}'
    .format(clf.score(X_train, y_train)))
print('Accuracy of Decision Tree classifier on test set: {:.2f}'
    .format(clf.score(X_test, y_test)))

#KNN
from sklearn.neighbors import KNeighborsClassifier
knn = KNeighborsClassifier()
knn.fit(X_train, y_train)
print('Accuracy of K-NN classifier on training set: {:.2f}'
    .format(knn.score(X_train, y_train)))
print('Accuracy of K-NN classifier on test set: {:.2f}'
    .format(knn.score(X_test, y_test)))

#Gaussian Naive Bayes
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb.fit(X_train, y_train)
print('Accuracy of GNB classifier on training set: {:.2f}'
    .format(gnb.score(X_train, y_train)))
print('Accuracy of GNB classifier on test set: {:.2f}'
    .format(gnb.score(X_test, y_test)))
```

#Support Vector Machine

```
from sklearn.svm import SVC
svm = SVC()
svm.fit(X_train, y_train)
print('Accuracy of SVM classifier on training set: {:.2f}'
    .format(svm.score(X_train, y_train)))
print('Accuracy of SVM classifier on test set: {:.2f}'
    .format(svm.score(X_test, y_test)))
```

5.2 PARAMETERS:

The input parameters mentioned in dataset are:

1. Sales growth
2. PAT growth
3. Return on capital employed
4. Total assets
5. Debt equity ratio

5.3 DATASET:

The classification goal is to predict whether the company is fit for acquiring/merging or not (variable 'Output' having value 0 or 1).

Following are snapshots of the data. The rows are the companies and the columns are the parameters taken.

SG stands for Sales Growth

PATG stands for PAT Growth

ROCE stands for Return on Capital Employed

TA stands for Total Assets

DER stands for debt equity ratio

	A	B	C	D	E	F
1	SG	PATG	ROCE	TA	DER	Output
2	5	5	50	10	5	0
3	5	20	17	30	80	0
4	20	30	51	80	10	1
5	30	30	60	10	70	1
6	10	40	10	5	8	1
7	52	10	10	4	62	0
8	75	2	18	50	10	1
9	44	55	14	10	7	1
10	21	14	13	80	10	1
11	75	52	55	18	41	1
12	80	17	10	8	2	1
13	10	53	14	73	11	1
14	12	16	18	69	17	0
15	55	69	41	55	54	1

Figure.8- Target data of 1-15 companies.

	A	B	C	D	E	F
16	14	21	16	74	78	1
17	31	10	14	13	74	0
18	11	7	62	31	33	0
19	32	10	17	15	60	0
20	60	11	10	72	33	1
21	10	5	6	20	10	0
22	16	29	38	40	63	0
23	37	11	41	23	32	0
24	11	27	38	16	67	0
25	60	17	50	30	63	1
26	12.7	11.7	38.7	45	78	0
27	16.77	19.8	12.78	84	30.8	1
28	18.9	54.21	8.67	8.74	33.33	1
29	16.08	66.7	31.8	6.77	31.07	1
30	12.77	17.78	63.45	36.5	86.8	0

Figure.9- Target data of 16-30 companies.

	A	B	C	D	E	F
31	17.77	13.08	25	19.7	45	0
32	24	25.07	11.78	31	65.05	0
33	35	55	63.78	14.7	68.7	1
34	19.06	42.77	64.07	72.11	36.7	1
35	14.5	13.4	52.7	64.2	89	1
36	33.7	12.5	66.78	54.1	72.11	1
37	35.9	46.7	66.78	99	32	1
38	35	3	52	88	63	1
39	64	33	82	63	5	1
40	34	9	13	52	63	0
41	16	52	36	54.7	27	1
42	53	69	45.8	23.7	62	1
43	25	11.9	36	43	22.8	0
44	33.9	11.4	34	22	38	0
45	54	67	88.7	42	46	1

Figure.10- Target data of 31-45 companies.

	A	B	C	D	E	F
46	14	24	37	22.8	43	0
47	87.1	56	36	23.7	11.5	1
48	53	45	64	78.5	27.8	1
49	17.9	22.6	38.7	46	40	0
50	54	66	75.4	25.4	46	1
51	8	45	23.9	14.9	44	0
52	56	87.5	12.6	57.8	23	1
53	64	57.3	66.1	23	45	1
54	69	78.5	36.8	12.5	64	1
55	46	25	42.8	11.5	23	0
56	36	32.4	19.7	46.8	23.9	0
57	63	52.9	11.5	67.8	45	1
58	87	56.8	67.9	44.2	21	1
59	46	23	22.8	46.7	23.4	0
60	79.5	63.5	21.6	53.8	22.5	1

Figure.11- Target data of 46-60 companies.

	A	B	C	D	E	F
61	55.4	23.6	65.2	87.1	23	1
62	12	24.6	32.6	44	43	0
63	16	35.9	42	27	34.6	0
64	42.6	24.7	43.9	11.2	14	0
65	88.5	67.5	14.2	87	32	1
66	44	36.5	23.7	14.5	22.5	0
67	36	32.8	11.5	23.4	44.6	0
68	14.9	23.5	22	38	32.9	0
69	22.6	46.9	42.7	14.6	12	0
70	59	57.4	63	62.6	12	1
71	54	62	33.5	22.5	64	1
72	12	12.5	43	32.5	30	0
73	65	33	69.8	23	56.8	1
74	23	45	66	54.5	78.2	1
75	12.6	44.5	12.3	14	43	0

Figure.12- Target data of 61-75 companies.

	A	B	C	D	E	F
76	65	45	12	66	68.2	1
77	36	45	88	76.2	56.7	1
78	45	38.7	12.5	44.6	42.3	0
79	14.5	55.6	23.6	80	56	1
80	5	2.9	22.4	36.42	12.5	0
81	12.6	44.5	23.9	8.2	44.5	0
82	65	45	12.6	66	87.9	1
83	46.3	22.4	56	81	88.5	1
84	42	55	64.5	21	75.4	1
85	12	14.5	36.7	23	8.8	0
86	44.6	23.5	11.4	23.6	12.55	0
87	67	65.8	45.6	57	54	1
88	23	14	22.5	35.6	45.8	0
89	63	68.2	12.56	54.2	8.6	1
90	63.2	12.5	44.2	87	66	1

Figure.13- Target data of 76-90 companies.

5.4 OUTPUT:

```
[1]  """
     it takes data (like a CSV or TSV file, or a SQL database)
     it creates a Python object with rows and columns called data frame
     that looks very similar to table in a statistical software.
     """

     # Importing pandas module
     import pandas as pd
```

```
[2]  """
     The CSV file consisting of financial data of merger and acquisition
     is stored in google drive
     Collaborate this google file with the code
     by mounting it by using the following lines of code
     """

     from google.colab import drive
     drive.mount('/content/gdrive')
```

```
     Drive already mounted at /content/gdrive; to attempt to forcibly remount, call drive.mount("/content
```

Figure.14- Importing data file from google drive on google colab.

```
[3]  """
     The CSV file location is now given
     read_csv will read that file from mentioned location
     pandas library will convert this excel file
     into tabular format dataframe
     """

     # Making data frame
     import pandas as pd
     rock=pd.read_csv('gdrive/My Drive/book1.csv')
```

```
[4]  """
     top 5 rows of data frame are returned and stored in a new variable.
     No parameter is passed to .head() method
     since by default it is 5.
     """

     # Calling head() method
     rock.head()
```

Figure.15- Reading CSV dataset file and view dataset commands.

[4]

	SG	PATG	ROCE	TA	DER	Output
0	5.0	5.0	50.0	10.0	5.0	0
1	5.0	20.0	17.0	30.0	80.0	0
2	20.0	30.0	51.0	80.0	10.0	1
3	30.0	30.0	60.0	10.0	70.0	1
4	10.0	40.0	10.0	5.0	8.0	1

```
[7]  # Import necessary libraries for visualisation
     from pandas.plotting import scatter_matrix
     from pandas.plotting import andrews_curves

     # Builtin colormaps, colormap handling utilities, and the ScalarMappable mixin.
     from matplotlib import cm
     import matplotlib.pyplot as plt
```

Figure.16- Dataset samples output and library import.

```
[7]  """
     Organizing the data and looking at it and forming input vectors
     To get a better understanding of what the dataset contains
     and how we can use the data to train our model
     Each financial parameter plays role in determining the output
     So each parameter is an input vector
     """

     # Organizing the data
     feature_names = ['SG', 'PATG', 'ROCE', 'TA','DER']
     """
     SG= Sales growth
     PATG= PAT Growth
     ROCE= Return on Capital Employed
     TA= Total assets
     DER= Debt equity ratio
     """

     # Defining input and output vectors
     X = rock[feature_names]
     Y = rock['Output']
```

Figure.17- Dataset organization.

```
[7]  ROCE= Return on Capital Employed
     TA= Total assets
     DER= Debt equity ratio
     """

     # Defining input and output vectors
     X = rock[feature_names]
     Y = rock['Output']


     # Scatter matrix plot
     scatter_matrix(X)
     print('     SCATTER MATRIX PLOT')

     # Density plot
     scatter_matrix(X, diagonal='kde')
     plt.show()

     # Andrews curve
     plt.figure()
     andrews_curves(rock, 'Output', colormap='winter')
     print('       ANDREWS CURVE')
```

Figure.18- Different visualisation of dataset.

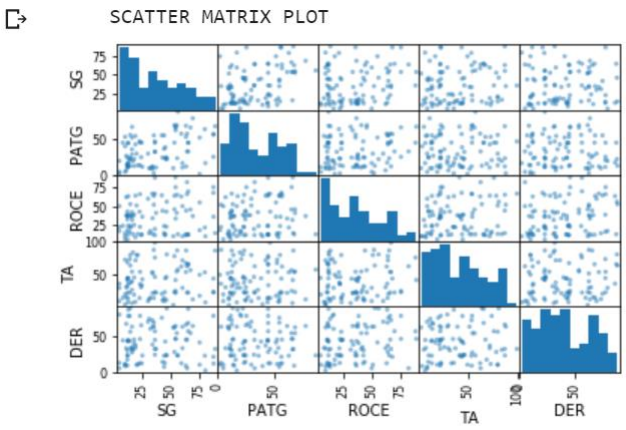


Figure.19- Scatter matrix plot output.

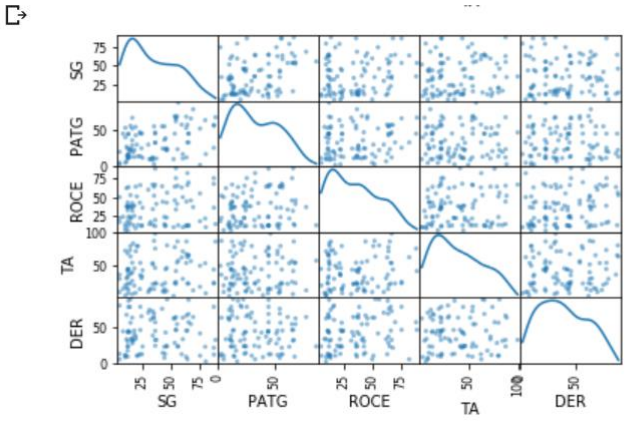


Figure.20- Density matrix plot output of dataset.

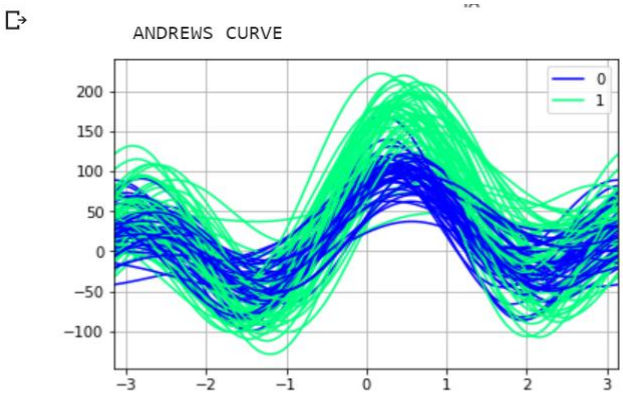


Figure.21- Andrews' curve for Output parameter of given dataset.

```
[8]  # Creating train & test samples
     from sklearn.model_selection import train_test_split
     X_train, X_test, y_train, y_test = train_test_split(X, Y, random_state=0)

     # This package provides several common utility functions and transformer classes
     # It changes raw feature vectors into a representation that is suitable for estimators.
     # Transforms features by scaling each feature to a given range which is (0,1) by default
     from sklearn.preprocessing import MinMaxScaler
     scaler = MinMaxScaler()

     # Fit to data, then transform it.
     X_train = scaler.fit_transform(X_train)

     # Scaling features of X_test according to feature_range (default=(0,1)).
     X_test = scaler.transform(X_test)
```

Figure.22- Splitting dataset into training and testing samples and transforming them.

```
[9]  # Logistic Regression

     # Import Library
     from sklearn.linear_model import LogisticRegression

     # Create logistic regression object
     logreg = LogisticRegression()

     # Train the model using the training sets and check score
     logreg.fit(X_train, y_train)

     # Predict output
     predicted=logreg.predict(X_test)
     print(predicted)

     # Calculate accuracy of training and testing dataset
     print('Accuracy of Logistic regression classifier on training set: {:.2f}'
          .format(logreg.score(X_train, y_train)))
     print('Accuracy of Logistic regression classifier on test set: {:.2f}'
          .format(logreg.score(X_test, y_test)))
```

Figure.23- Logistic regression.

```
[9]  from sklearn.linear_model import LogisticRegression

     # Create logistic regression object
     logreg = LogisticRegression()

     # Train the model using the training sets and check score
     logreg.fit(X_train, y_train)

     # Predict output
     predicted=logreg.predict(X_test)
     print(predicted)

     # Calculate accuracy of training and testing dataset
     print('Accuracy of Logistic regression classifier on training set: {:.2f}'
          .format(logreg.score(X_train, y_train)))
     print('Accuracy of Logistic regression classifier on test set: {:.2f}'
          .format(logreg.score(X_test, y_test)))

     [1 0 1 0 1 1 0 1 1 1 0 0 1 0 1 1 0 0 1 0 0 0 0 1]
     Accuracy of Logistic regression classifier on training set: 0.88
     Accuracy of Logistic regression classifier on test set: 0.88
```

Figure.24- Accuracy of logistic regression.

```
[10] #Decision Trees

     #Import package
     from sklearn.tree import DecisionTreeClassifier

     #Create tree object
     clf = DecisionTreeClassifier().fit(X_train, y_train)

     print('Accuracy of Decision Tree classifier on training set: {:.2f}'
          .format(clf.score(X_train, y_train)))
     print('Accuracy of Decision Tree classifier on test set: {:.2f}'
          .format(clf.score(X_test, y_test)))
```

```
Accuracy of Decision Tree classifier on training set: 1.00
Accuracy of Decision Tree classifier on test set: 1.00
```

Figure.25- Decision tree algorithm code and output.

```
[11] #KNN
     from sklearn.neighbors import KNeighborsClassifier
     knn = KNeighborsClassifier()
     knn.fit(X_train, y_train)
     print('Accuracy of K-NN classifier on training set: {:.2f}'
          .format(knn.score(X_train, y_train)))
     print('Accuracy of K-NN classifier on test set: {:.2f}'
          .format(knn.score(X_test, y_test)))
```

```
Accuracy of K-NN classifier on training set: 0.88
Accuracy of K-NN classifier on test set: 0.83
```

```
[12] # Gaussian Naive Bayes

     from sklearn.naive_bayes import GaussianNB
     gnb = GaussianNB()
     gnb.fit(X_train, y_train)
     print('Accuracy of GNB classifier on training set: {:.2f}'
          .format(gnb.score(X_train, y_train)))
     print('Accuracy of GNB classifier on test set: {:.2f}'
          .format(gnb.score(X_test, y_test)))
```

Figure.26- K-NN code with accuracy output and Gaussian Naïve Bayes algorithm code.

```
[12]
     Accuracy of GNB classifier on training set: 0.97
     Accuracy of GNB classifier on test set: 0.96
```

```
[13] #SVM

     #Import library
     from sklearn.svm import SVC

     # Create SVM classification object
     svm = SVC()

     #Fitting model created
     svm.fit(X_train, y_train)

     print('Accuracy of SVM classifier on training set: {:.2f}'
          .format(svm.score(X_train, y_train)))
     print('Accuracy of SVM classifier on test set: {:.2f}'
          .format(svm.score(X_test, y_test)))
```

```
Accuracy of SVM classifier on training set: 0.86
Accuracy of SVM classifier on test set: 0.83
```

Figure.27- Accuracy of Gaussian Naïve Bayes algorithm and SVM algorithm code and output.

5.5 ANALYSIS OF OUTPUTS:

1. The average profit margin i.e growth of target companies exceed the average of non-target companies. This indicates better earnings of companies that are likely to be potential targets.
2. Return on capital employed for target companies is greater than that of non-target companies. This shows better profitability of target companies along with enhanced efficiency in more judicious use of capital ie investing it in areas it can produce better yields.
3. The debt equity ratio of target companies is less than that of non-target companies. This indicates poor liquidity of target companies which makes it more likely for target companies to consent to acquisitions ie due to an inability in meeting its short term liabilities with current assets.

5.6 EFFICIENCY:

The accuracy of the each algorithm is different which defines their efficiencies. We have computed accuracy of each algorithm for training and testing dataset.

Algorithm Name	Accuracy on training dataset	Accuracy on testing dataset
Logistic Regression	88%	88%
Decision Tree	100%	100%
KNN	88%	83%
Gaussian Naive Bayes	97%	96%
SVM	86%	83%

Tab 1. Efficiency.

Chapter 6

Application of Project

6 APPLICATION OF PROJECT:

- The product we are developing seeks to solve the initial and the most time consuming step of investment banks- idea generation for clients to find targets for mergers and/or acquisitions.
- The aim is to eventually create a product so robust that it can eliminate the need for manual labour, most often performed by analyst level employees, in screening various potential targets and arriving at a small but focussed group of companies that can be realistic targets in contention.
- Since this is a crucial step that all investment banks are engaged in, we hope to licence it to both mid-market and bulge bracket investment banks.
- Since we will eventually be an industry adaptive software, we are likely to receive overall acceptance in India. In the year of 2016 (January to December), Indian investment banks earned a total revenue of $336 million. Analysts are paid between 10 LPA and 18 LPA in bulge bracket banks (such as JP Morgan Chase, Morgan Stanley, Citi Group, etc.) and between 5 LPA and 9 LPA in mid-market banks (such as Avendus Capital, O3 Capital, Veda Group, etc.).
- Given that analysts constitute a high percentage of total employees, the market size is capped at a minimum of INR 50 million.
- Although investment banking has historically being a cyclical business, growing and shrinking with the market, the era of technology and regulation has caused bulge bracket banks to lose market share to boutique/ mid-market banks progressively over time.
- This has created a need for banks to be efficient and client centric.
- The change in operations caused by this directly benefits our concept. Banks are rallying to be more specialised in their services.
- Being in a unique position of providing a software which will churn results in matter of minute and having industry focussed modules, we will be able to promise a low turn-around time as well as a highly specialised service.

6.1 PROJECT BUDGET:

DATABASE

The data required to operationalise the variables defined as ratios is derived from the financial statements for Indian listed companies and balance sheet date price information. The financial statement information was sourced from the moneycontrol data base, which includes annual financial statement data for all Indian listed companies. The database includes industry classifications for all firms, facilitating the construction of industry relative ratios. Lists of takeover bids and their respective success were obtained from the internet. This information makes possible the calculation of variables for relative merger activity between industries.

6.2 INDUSTRY SECTORS:

The industries are included based on a close enough P/E ratio and EV/EBITDA margin, they are:

1. Media and Entertainment
2. Personal Care
3. Retail
4. Textiles
5. Readymade Apparel
6. Food Processing
7. Cosmetics

Chapter 7

Future Scope and conclusion

7. FUTURE SCOPE AND CONCLUSION:

Mergers & Acquisitions (M&A) is an always topic in the security market, which is an important way and tool to expand and shrink capital, harmonize and select, control and anti-control. M&A is also the quickest way of industrial integration and structure adjustment. Since nineteen century, M&A waves of developed countries are higher and higher, so this M&A project can help the developing companies to compete in the ever-changing and demanding market. [20]

The aim is to eventually create a product so robust that it can eliminate the need for manual labour, most often performed by analyst level employees, in screening various potential targets and arriving at a small but focussed group of companies that can be realistic targets in contention. Since this is a crucial step that all investment banks are engaged in, we hope to licence it to both mid-market and bulge bracket investment banks. Since we will eventually be an industry adaptive software, we are likely to receive overall acceptance in India. In the year of 2016 (January to December), Indian investment banks earned a total revenue of $336 million. Analysts are paid between 10 LPA and 18 LPA in bulge bracket banks (such as JP Morgan Chase, Morgan Stanley, Citi Group, etc.) and between 5 LPA and 9 LPA in mid-market banks (such as Avendus Capital, O3 Capital, Veda Group, etc.). Given that analysts constitute a high percentage of total employees, the market size is capped at a minimum of INR 50 million. Although investment banking has historically being a cyclical business, growing and shrinking with the market, the era of technology and regulation has caused bulge bracket banks to lose market share to boutique/ mid-market banks progressively over time. This has created a need for banks to be efficient and client centric. The change in operations caused by this directly benefits our concept. Banks are rallying to be more specialised in their services. Being in a unique position of providing a software which will churn results in matter of minute and having industry focussed modules, we will be able to promise a low turn-around time as well as a highly specialised service. [21]

The following things have to be done in order to upscale the project. The product innovation would be carried out in four phases to increase the scalability, reach and extent of it while maintaining the tractability.

Phase 1 : *INCREASING NUMBER OF PARAMETERS:*

The number of quantitative as well as the qualitative parameters to be considered has to be increased to reduce the error rate and improve the target predicting efficiency. For e.g. Higher

no of solvency, growth, profit ratios can be taken into account. However, there are certain intuitive decisions which the acquirer undertakes which are very hard to quantify. Also, it is difficult to quote a price for qualitative factors like the working culture, the skill set of the workers, goodwill. Mergers and acquisitions typically involve a substantial amount of due diligence by the buyer. The buyer is concerned not only with the likely future performance of the target company as a stand-alone business; it will also want to understand the extent to which the company will fit strategically within the larger buyer organization. This might require a qualitative approach to due diligence but there can be parameters which can quantify these aspects.

- Budget on Research and Development: The number of patents held by the company and other intellectual property might be a key in identifying the inherent value and approach to growth.
- Litigation fees: Filed or pending litigation, all complaints and other pleadings, Litigation settled and the terms of settlement Claims threatened against the company along with threatened government proceedings might show the amount of liability. Carbon footprint: This should reflect how green the company policy is.

Phase 2: *INCLUSION OF OTHER SECTORS:*
The first model will be restricted to a particular sector as each sector has field specific parameters and degree of compatibility with a specific neural network. For e.g. technological sector is more intellectual property based and has a better efficiency with patent semantic analysis based neural network. The input database can include several blocks each with a separate neural net specific to that industry and parameters that characterise it. The potential targets seem to have characteristics of low financial leverage, low profit margin, high liquidity and slow increase. These characteristics can be used to spot target companies across different sectors in order to broaden the spectrum. One constraint with taking input samples across sectors is that different sectors have different industry norms of the acceptable values of the financial ratios, for e.g., P/E ratio varies across different sectors.

Phase 3: *INCLUSION OF OTHER REGIONAL DEMOGRAPHICS:*
The first model is built on companies in India but can be expanded to other regions. Cross country mergers require accounting of different interest rates, currency values, government policy and other macroeconomic variables. An input database and neural network that

incorporates the parameters from that region specific index to a common denomination can be implemented.

Phase 4: *INCLUDING THE UNLISTED COMPANIES:*
A user interface like a website or such can be designed that provides a platform to nascent start-ups that wish to be acquired. The website could gather information and build a database for companies that are not publicly listed. This would be like forum for the meeting of acquirers and acquires that don't necessarily have the means or access to big acquiring companies.

Phase 5: INCLUDING THE PRICE PREDICTIONS:
It is an important premise for acquisition success to make sure the price of acquired firm reasonably. As an acquirer, only if it thinks benefit of the acquired capital is more than the cost (including acquiring fee), it is willing to acquire other firms. As the acquired, only if it thinks price of the sold capital is enough to cover its present value and opportunity cost, it is willing to be acquired. Higher or lower price, one of them is dissatisfied with it, will lead to failure of acquisition.[21]

APPENDIX

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