A TECHNICAL REPORT ON STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

UNDERTAKING **AT E-PROCESS CONSULTING**, IKEJA, LAGOS STATE.
FROM MARCH 2020 TO SEPTEMBER 2020

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SUBMITTED IN PARTIAL FULFILMENT
OF THE AWARD OF BACHELOR OF SCIENCE (B. SC)
IN
COMPUTER SCIENCE

SIWES TECHNICAL REPORT

CONCEPT

My Industrial training report highlights the experience harnessed during the 6 months of industrial training inception at E-Process Consulting in Ikeja, Lagos state.

My training was on Networking services, database management using ORACLE and I was also given the opportunity to assist the company with my knowledge on data management services including the use of AI in business sectors.

During this period, I acquired practical knowledge on how to troubleshoot, manage, replace and install faulty networking cables and systems and I also assisted in providing various sectors of the company the perfect network they need for the smooth running of the company.

This report discusses the technical skills gained during the training period and justifying the relevance of the scheme in equipping students with needed technical competence to thrive in the real world.

ACKNOWLEGDEMENTS

I thank Jehovah God who has contributed in no small way for seeing me through the Industrial training despite the COVID-19 global pandemic, for giving me the insight to choose Computer Science as my field of study and for turning me into a razor with a blade.

I'm also using this opportunity to thank the Department of mathematics, faculty of science for their quick release of students into the industrial field and the Industrial Training Fund for this initiative of exposing us to the industrial experience.

I'm grateful to E-process consulting Limited for their consideration and opportunity to be exposed to an industrial environment. To Mr. Rufai and Mr. Segun Ajala for their interest in me and making sure that I understand some of the lingo involved in Networking Services, I say thank you.

Furthermore, I want to also thank my Industrial supervisor, Mr. Niyi fasanmoye of the Enterprise Resource Planning Department for taking me on Oracle Database management and also allowing me to share my knowledge with the team (Mr. Ayo, Mr. Tola and Mr. Tolu) on AI in Business.

Furthermore, I want to thank my parents for their financial support, making sure that I don't miss work.

Lastly, to my Institution based supervisor Dr. Mrs. Folorunso who also through her impactful and innovative teachings and insightful research materials has broadened my scope of what being a computer scientist is all about, thank you ma.

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CHAPTER 1

INTRODUCTION

1.1 STUDENT WORK EXPERIENCE SCHEME

The student industrial work Experience Scheme (SIWES), is a skill development programme initiated by the Industrial Training Fund (ITF) in 1937 to bridge the gap between theory and practice among students of engineering and technology in institutions of higher learning in Nigeria.

It provided for "on-the-job" practical experience for students as they are exposed to work methods and techniques in handling equipment and machinery that may not be available in their institutions.

At inception in 1974, the scheme started with 784 students from 11 institutions and 104 eligible courses. By 2008, 210,390 students from 219 institutions participated in the scheme with over 112 eligible courses. However, the rapid growth and expansion of SIWES' has occurred against the backdrop of successive economic crises which have affected the smooth operation and administration of the scheme.

Most industries in Nigeria today, are operating below installed capacity while others are completely shut down. (Manufacturing Association, 2003-2006). This has impacted negatively on the Scheme as institutions of higher Learning find it increasingly difficult to secure placement for students in industries where they could acquire the needed practical experience.

The main thrust of ITF programme and services is to simulate human performance, improve productivity, and induce value-added production in industry and commerce. Through its SIWES and Vocational and Apprentice Training Programme, the Fund builds capacity for graduates and youth self-employment, in the context of small-scale industrialization in the economy.

Participation in SIWES has become a necessary pre-condition for the award of Diploma and Degree certificates in specific disciplines in most institutions of higher learning in the country, in accordance with the education policy of

government. There operations include the ITF, the coordinating agencies (NUC, NCCE, and NBTE), employers of labour and the institutions.

They are funded by the Federal Government of Nigeria Beneficiaries - Undergraduate students of the following: Agriculture, Engineering, Technology, Environmental, Science, Education, Medical Science and Pure and Applied Sciences.

The objective of SIWES among others includes to:

i. Prepare students for the industrial work situation which they are likely to meet after graduation,
ii. Provide an avenue for students in institutions of higher learning to acquire industrial skills and experience in their approved course of study,
iii. Expose students to work methods and techniques in handling equipment and machinery not available in their institutions,
iv. Provide students with an opportunity to apply their knowledge in real work situation thereby bridging the gap between theories and practices, and
v. Enlist and strengthen employers' involvement in the entire educational process and prepare students for employment in industry and commerce (Information and Guideline for SIWES, 2002)

Duration: Four months for Polytechnics and Colleges of Education, and Six months for the Universities. In second semester, the fourth year of the undergraduate degree in the Nigeria University of Technology is used for this industrial training program which is a period of six months.

The inception of my SIWES was at E-PROCESS CONSULTING located at 3B Dotun Jolaoso Close, off Adeboye Solanke Street, off Allen Avenue, Ikeja, Lagos.

1.2 COMPANY'S PROFILE

E-PROCESS CONSULTING located at 3B Dotun Jolaoso Close, off Adeboye Solanke Street, off Allen Avenue, Ikeja, Lagos provides best level services using first-class methodologies with a technology driven approach.

It is owned and managed by CEO Mr. Segun Ajala. It was established in 2010 with the aim of identifying, protecting, detecting, recovering data. They also use the latest technologies to provide quality products to customers such as the banking industries, SEPLAT, INDOMIE, JUMIA, AIR PEACE and so on.

It partners with CISCO, HP, MICROSOFT, IBM and various IT industries and are known for their competence in delivering awesome services and projects.

1.3 COMPANY'S SCOPE OF WORK

As an IT industry, E-Process provides these services listed below to various clients to solve their most pressing challenges from strategy through execution:

1. **Identify:**
    - Network Access Control
    - Managed Vulnerability assessment and Remediation

2. **Protect:**
    - Privilege Account security and Monitoring
    - Cyber security secure configuration
    - Data protection and Encryption
    - Email and Web security
    - Application Software security
    - Cloud Security
3. **Detect:**
    - Managed security operations center
    - Boundary Defense

4. **Respond:**
    - Incident response and management

5. **Recover:**
    - Penetration Testing
    - Data Recovery and backup

Within these scope/operation lies various department and qualified experts to handle the clients pressing challenges.

E-process consulting is made up of 2 departments with 3 sections:

1. **CTO Department:** This department is also known as the Chief Technological Office Department. It is an executive-level position in the company whose occupation is focused on scientific and technological issues in the company. We have two leading types of the CTO at E-Process Consulting— operational management and technical leadership (2 sections).

- **Operational management:** These specialists typically don't have considerable coding background. CTO of this type may have studied finance, project management, mentoring, and other non-technical skills.
  As a result, CTOs of this type usually manage organizational moments without solving any tech issues. In this section we have the (Service Desk/Support Manager, Sales Executives and Pre-sales security expert.)

- **Technical leadership:** And conversely, these specialists have a solid background in providing software development services and leads an engineering team. They are in fact senior developers that can solve problems faster and find the best solutions. This section is a perfect that reckons that our product will interest our clients and investors through the quality technologies.

In this section we also have the (Network engineer manager, Hardware engineer manager, and Application engineer manager.)

2. **HR/Accounting Department:** The company's human resource department is tasked with the training and development of its workers, who are considered some of the company's most important resources.

   Also known as human resources (HR), the human resource department's mission is to make sure the company's employees are adequately managed, appropriately compensated, and effectively trained. The department is also responsible for recruiting, hiring, firing, and administering benefits. In this section we also have the (ERP [Enterprise Resource Planning], Help Desk/Receptionist, Accountant, Office Assistant) (1 section).

1.4 COMPANY'S ORGANIOGRAM

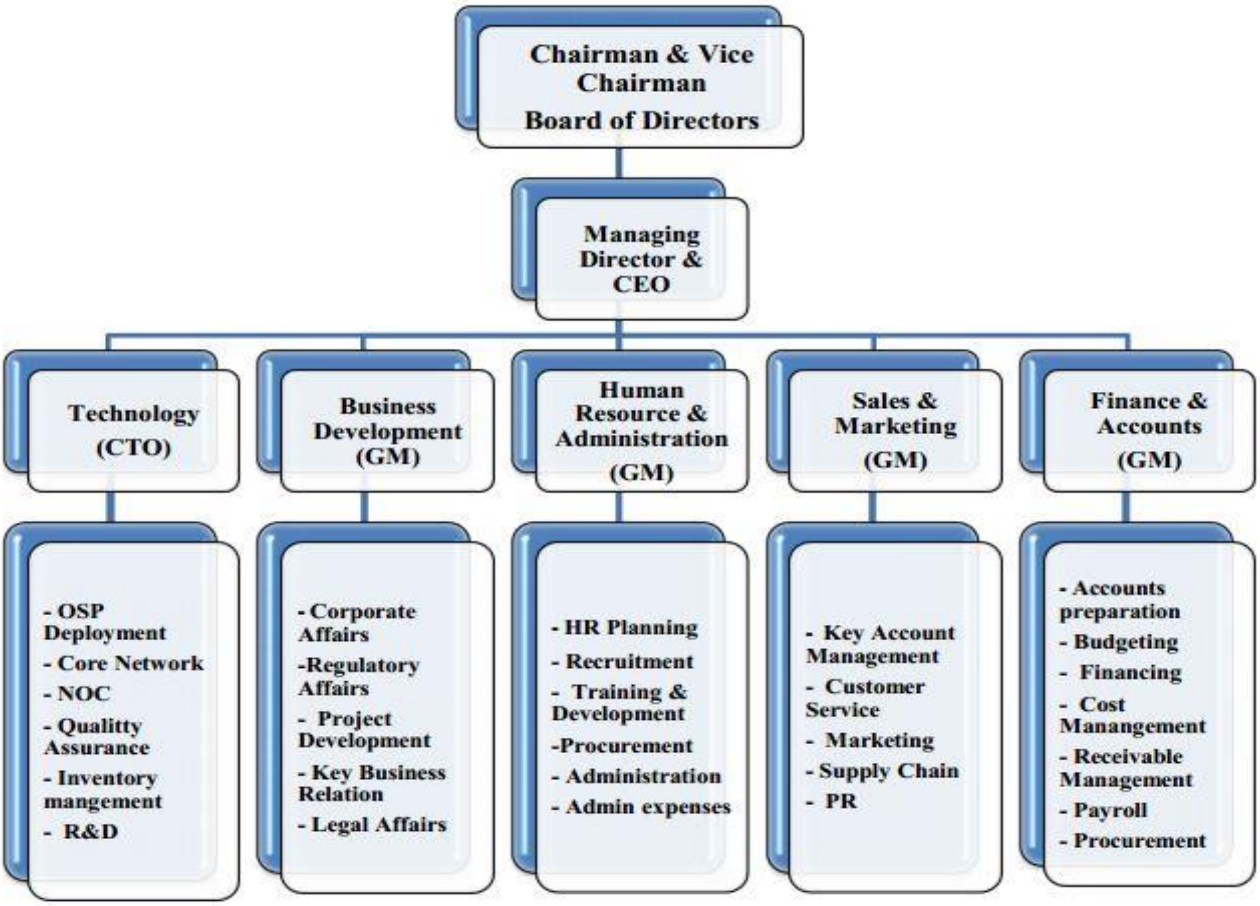


Figure 1

1.5 COMPANY'S WORKFLOW

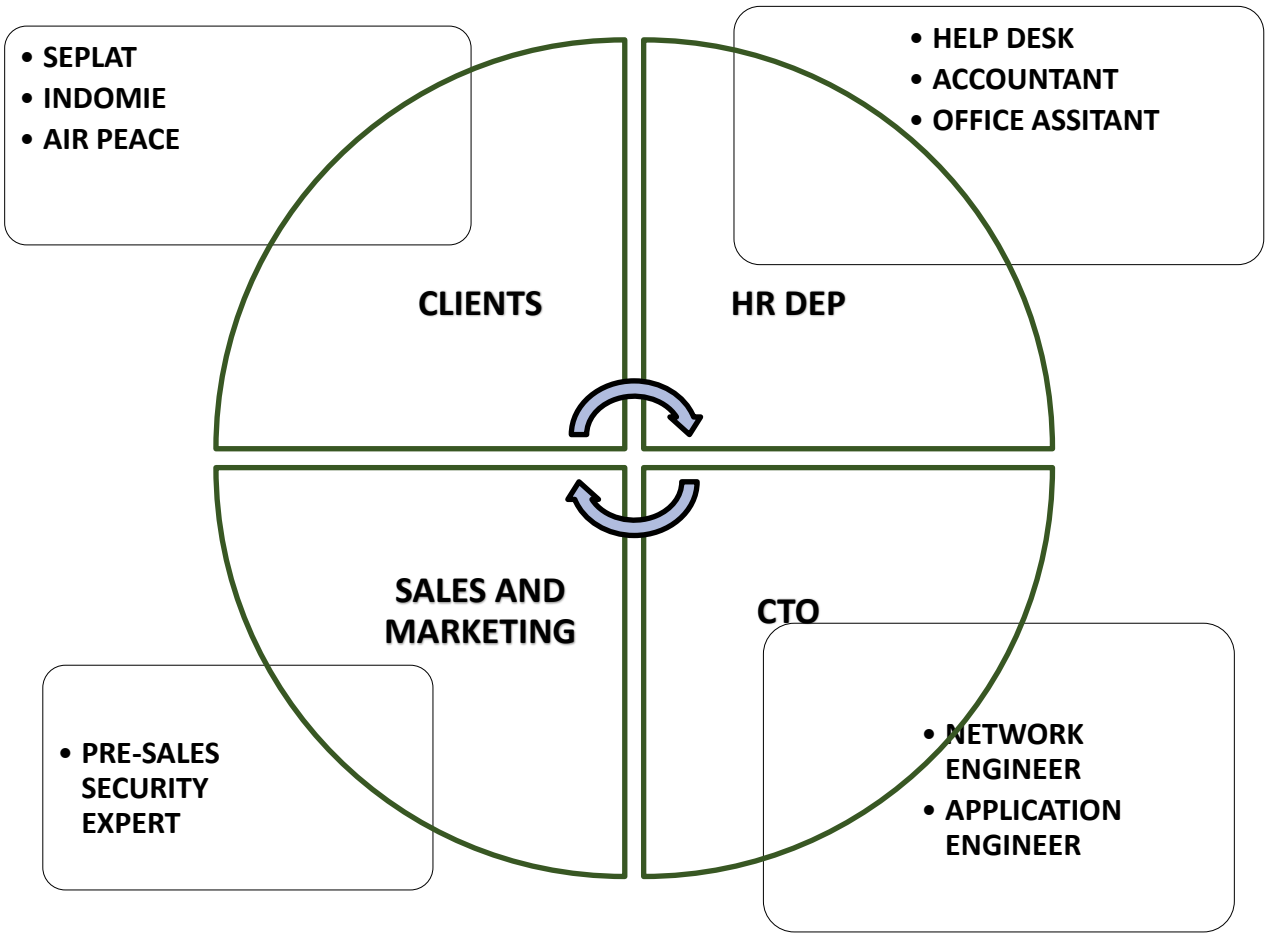


Figure 2

Note: Please refer to figure 1 for a clearer understanding on the organization workflow.

CHAPTER 2

THE TRAINING PROGRAM

2.1 DESCRIPTION OF WORKDONE

During my internship at E-Process Consulting I was designated to the ERP section and also to the CTO department (Technical Leadership Section) to assist the team with my knowledge on AI (Artificial Intelligence) in Business. The various aspect of programming, tools used and its implementation will be discussed in chapter 3.

My duties included rebooting all Computers in sections, fixing server failures either by disabling and enabling network adapters or pinging all systems to check if the network cables are receiving data or not (this will also be highlighted in chapter 3).

2.1.0 PROGRAMMING ASPECTS (PYTHON)

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

Python was created in the late 1980s, and first released in 1991, by Guido van Rossum as a successor to the ABC programming language. Python 2.0, released in 2000, introduced new features such as list comprehensions, and a garbage collection system with reference counting, and was discontinued with version 2.7 in 2020.

Python 3.0, released in 2008, was a major revision of the language that is not completely backward-compatible and much Python 2 code does not run unmodified on Python 3. With Python 2's end-of-life, only Python 3.6 and later are supported, with older versions still supporting e.g. Windows 7 (and old installers not restricted to 64-bit Windows).

As of December 2020 Python ranked third in **TIOBE's** index of most popular programming languages, behind C and Java.

As demands for data scientist and AI scientist increases globally python proves to be climbing the ladder being the 1st most popular programming language.

I also used python at the *CTO department, it is embedded in software as ANACONDA NAVIGATOR (Python 3.8)* which contains versatile library sources for the implementation of data analysis (inspecting, cleaning, transformation and modelling), and Neural Networks.

ANACONDA NAVIGATOR is an online and offline multifunctional software.

2.1.1 PYTHON DESIGN PHILOSOPHY AND FEATURES

Python uses dynamic typing and a combination of reference counting and a cycle-detecting garbage collector for memory management. It also features dynamic name resolution (late binding), which binds method and variable names during program execution.

Python's design offers some support for functional programming in the Lisp tradition. It has filter, map and reduce functions, list comprehensions, dictionaries, sets, and generator expressions.

The standard library has two modules (itertools and functools) that implement functional tools borrowed from Haskell and Standard ML.

The language's core philosophy is summarized in the document "***The Zen of Python* (*PEP 20*)**" which includes aphorisms such as:

- Beautiful is better than ugly.
- Explicit is better than implicit.
- Simple is better than complex.
- Complex is better than complicated.
- Readability counts.

A common neologism in the Python community is *pythonic*, which can have a wide range of meanings related to program style. To say that code is pythonic is to say that it uses Python idioms well, that it is natural or shows fluency in the language, that it conforms with Python's minimalist philosophy and emphasis on readability.

In contrast, code that is difficult to understand or reads like a rough transcription from another programming language is called *unpythonic*.

2.1.2 PYTHON METHODS

Methods on objects are functions attached to the object's class; Python methods have an explicit "self" parameter to access instance data, in contrast to the implicit `self` (or `this`) in some other object-oriented programming languages (e.g., C++, Java, Objective-C, or Ruby).

2.1.3 PYTHON LIBRARIES

Python's large standard library, commonly cited as one of its greatest strengths, provides tools suited to many tasks. For Internet-facing applications, many standard formats and protocols such as MIME and HTTP are supported. It includes modules for creating graphical user interfaces, connecting to relational databases, generating pseudorandom numbers, arithmetic with arbitrary-precision decimals, manipulating regular expressions, and unit testing.

Some parts of the standard library are covered by specifications but most modules are not. They are specified by their code, internal documentation, and test suites. However, because most of the standard library is cross-platform Python code, only a few modules need altering or rewriting for variant implementations.

As of November 2019, the Python Package Index (PyPI), the official repository for third-party Python software, contains over 200,000 packages with a wide range of functionality, including:

- Automation
- Data analytics
- Databases
- Documentation
- Graphical user interfaces
- Image processing
- Machine learning
- Mobile Applications
- Multimedia
- Networking
- Scientific computing

- System administration
- Test frameworks
- Text processing
- Web frameworks
- Web scraping

2.1.4 PYTHON DATA TYPES

TYPE	MUTABILITY	DESCRIPTION	SYNTAX
BOOL	IMMUTABLE	BOOLEAN VALUE	True False
COMPLEX	IMMUTABLE	SEQUENCE OF BYTES	Bytes([120,105,150,160])
DICT	MUTABLE	Associative array (or dictionary) of key and value pairs; can contain mixed types (keys and values), keys must be a hashable type	{'cat': lion, tiger, panther}
FLOAT	IMMUTABLE	Double precision floating point number.	1.414
INT	IMMUTABLE	Integer of unlimited magnitude	42
STR	IMMUTABLE	A character string: sequence of Unicode codepoints	"" senatorial districts""

Other software used are **LINUX, ORION, ORACLE and VIRDI.**

CHAPTER 3

3.1 TOOLS USED AND IMPLEMENTATION

3.1.0 ORION PLATFORM

Figure 3

The ORION platform is a powerful, scalable infrastructure monitoring and managing platform designed to simplify IT administration for on-premises, hybrid and software as a service (SaaS) environments in a single plane of glass.

With it there's no need to struggle with multiple incompatible point monitoring products, as the Platform consolidates the full suite of monitoring capabilities into one platform with cross-stack integrated functionality.

In simple terms the ORION Platform makes it easier to monitor, analyze and manage the complete IT stack in on place.

Key features

- Single plane of glass
- Intelligent dynamic mapping
- Full stack event correlation for easy troubleshooting
- Hybrid cloud monitoring
- Modular and scalable architecture
- Centralized alerting and reporting

The following key features are explained as follows:

1. **Unified Data:** Customers today shouldn't have to deal with a collection of spreadsheets, incompatible tools, swivel-chair management, overpriced products and deployment services.

The SolarWinds Orion Platform can help conquer your infrastructure monitoring and management by offering superior tool consolidation for your environment while providing unique integrated functionalities, allowing customers to join dots and solve problems with accuracy and speed at an affordable price.

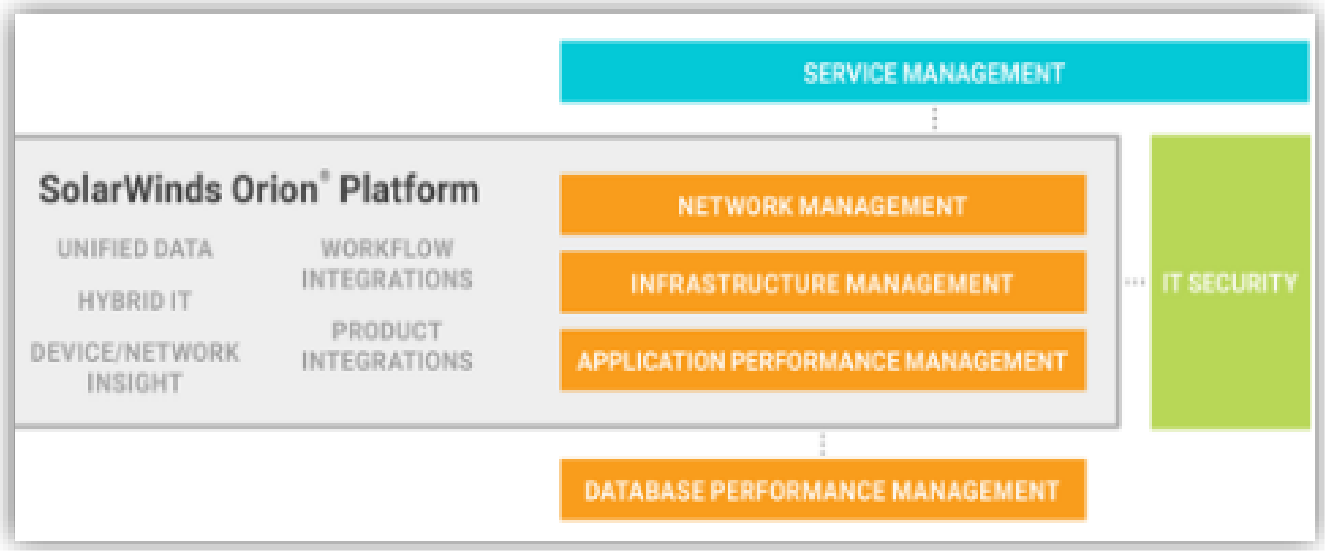


Figure 4 Orion's Platform

2. **Hybrid IT:** The IT landscape is evolving rapidly with applications, services and infrastructure both on-premises and in the cloud. Applications, which can be run on-premises today, may move to the cloud in the near future.

The pressing issue now is how to keep us p with all this changes?

The Orion Platform and many of its modules can monitor entities on-premises and in the cloud. It can also be deployed on-premises, in the cloud, or a mix.

It evolves with the latest IT trends.

3. **Device/Network Insight:** Networks today often contain complex hardware not well covered by standard monitoring tools. The SolarWinds Network Insight feature in the Orion Platform simplifies the management of complex network devices such as Cisco ASA firewalls, Cisco Nexus gear, Palo Alto Networks firewalls, and F5 BIG-IP by providing the right information for each device's unique role in the network.

4. **Product Integrations:** One of the goals of the SolarWinds Orion Platform is to allow customers to see the big picture across the complete IT stack as this provides small integration between several of the modules on the platform and approaching issues from different angles. This facilitates connected use cases for connected problems.

Additionally, integrations to native SolarWinds Orion Platform products such as in the database layer broadens the field of view.

Figure 5

5. **Workflow Integrations:** A key benefit for all the modules installed on the SolarWinds Orion Platform is being able to benefit from a common set of shared services offered by the platform.

This allows for better availability, insight and faster problem resolution with common services such as high availability, consolidated alerts and a consolidated message center. The platform can also be scaled out to meet business growth demands.

Figure 6 Orion's Workflow

3.1.1 ORACLE 9I DISCOVERER

The Oracle 9i Discoverer is a data access tool. It is used to view the information in the company's database.

The whole purpose of Discoverer is to help the ERP (Enterprise Resource Planning) team to view the data they want from the database, analyze it to support business decisions, and create reports to keep track of things.

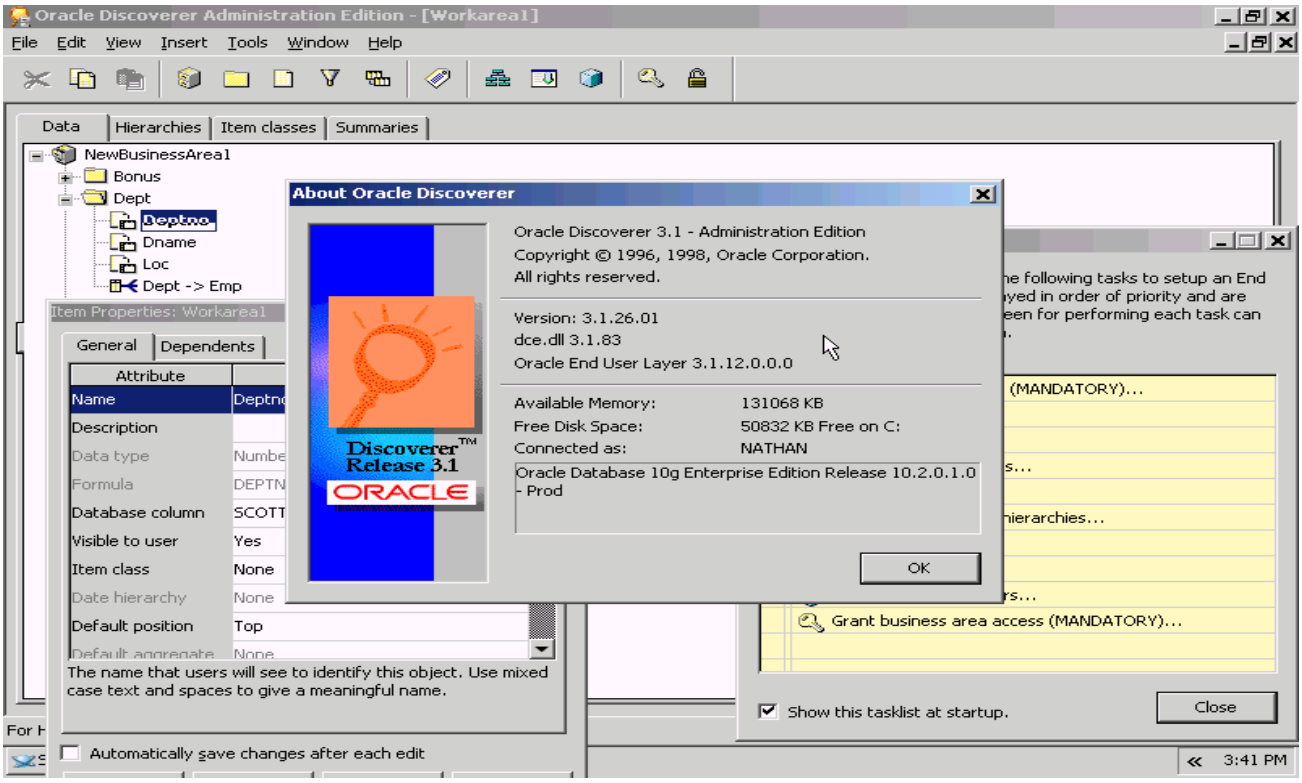


Figure 7 Oracle 9i Discoverer

Discoverer solves many of the problems normally associated with databases so that the team can easily:

- Find data that they know is in the database.

- See data displayed quickly without waiting for the computer to spend a long time searching through the entire database.
- View data in a familiar format that is easy to read and understand.
- Analyze data using a wide array of techniques including drilling up and down through the data's details, finding data that meets certain conditions or that falls within ranges you specify, sorting data, comparing results from *"what if"* scenarios, and so on.
- Prepare reports of analytical results and findings.
- Share data with others, and in other applications (such as Excel).

Understanding Workbooks and Worksheets

The workbook has pages, or worksheets, that contains data for the specific tasks. For example, if the workbook is for sales and profit data, one worksheet in it might be a table listing your profit for sales versus rentals. Another worksheet might be a comparison of your profit over the last two years by sales region.

The sample database that ill use with Discoverer contains data from a fictitious video store business. The sample data covers many topics including:

- Sales Region
- Year
- Department
- Sum of Profit
- Size of Store (in square feet)
- Type of Store Design (Compact, Modern, or traditional)
- Store Name, and so on.

Discoverer also comes with its own sample workbooks, that you can use to analyze the example data.

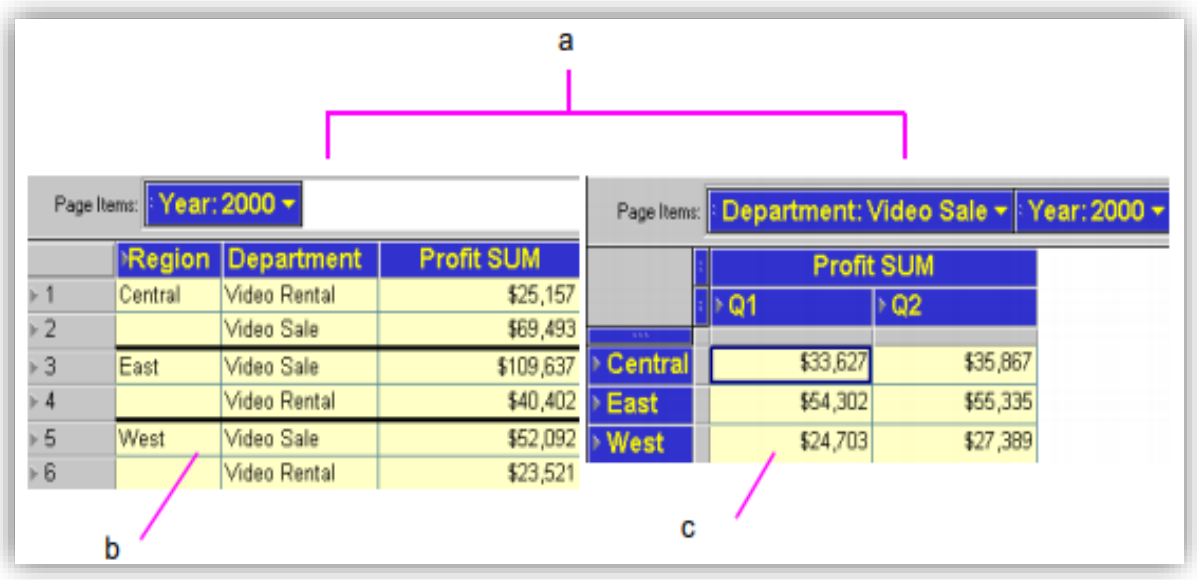


Figure 8 Sample Worksheet

Key to *Figure 8*

a. These two worksheets are from the same workbook. They are both designed for analyzing profit.

b. This worksheet is a table. It lists the data in a familiar tabular format.

c. This worksheet is a crosstab. It shows the data in a more aggregate form that is usually better for data analysis than tables.

About Queries

A *query* is simply a search of the database that finds and retrieves the data you want. Each worksheet in a workbook contains the result of a query. So, when you see the term "query" while working with Discoverer Desktop, you can think of it as a worksheet with retrieved data.

Opening a workbook

The ERP team usually supplies the various passwords and server access instructions to log on to Oracle9i Discoverer Desktop and open a workbook. The following steps explain the basic process.

Note: The ERP team has designed the workbooks that department can open.

If there are questions about the workbook names, whether you have access to them, the location of workbooks on company servers, and so on, the ERP team is informed.

To open a workbook:

- At the Windows Desktop, choose Discoverer Desktop from the Oracle Discoverer 9i Start menu.

The Oracle Discoverer connect dialog appears (Figure 1–6). Your user name should already be in the Username box. If not enter it in the Username box.

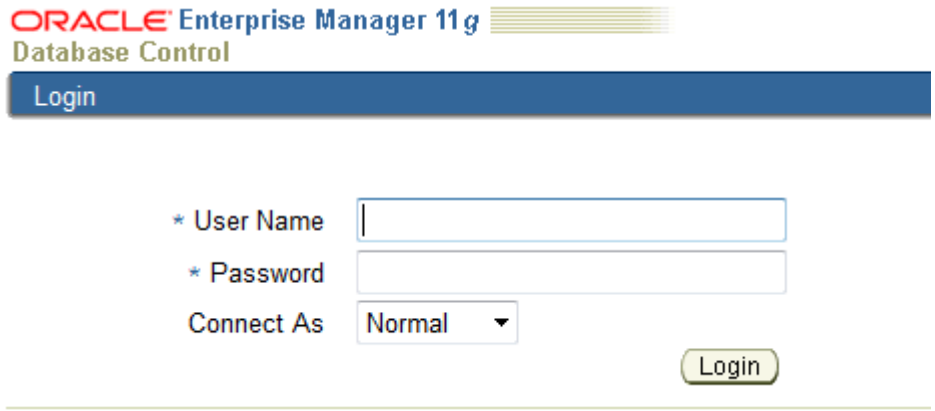


Figure 9 LOGIN Screen

- In the Password box, enter your password
- In the Connect box, enter the name of the database that you wish to use. See your Database Administrator for password and database name details.
- Click Connect. The first screen of the Workbook Wizard appears. The wizard steps you through the process to get the specific data you want to see.

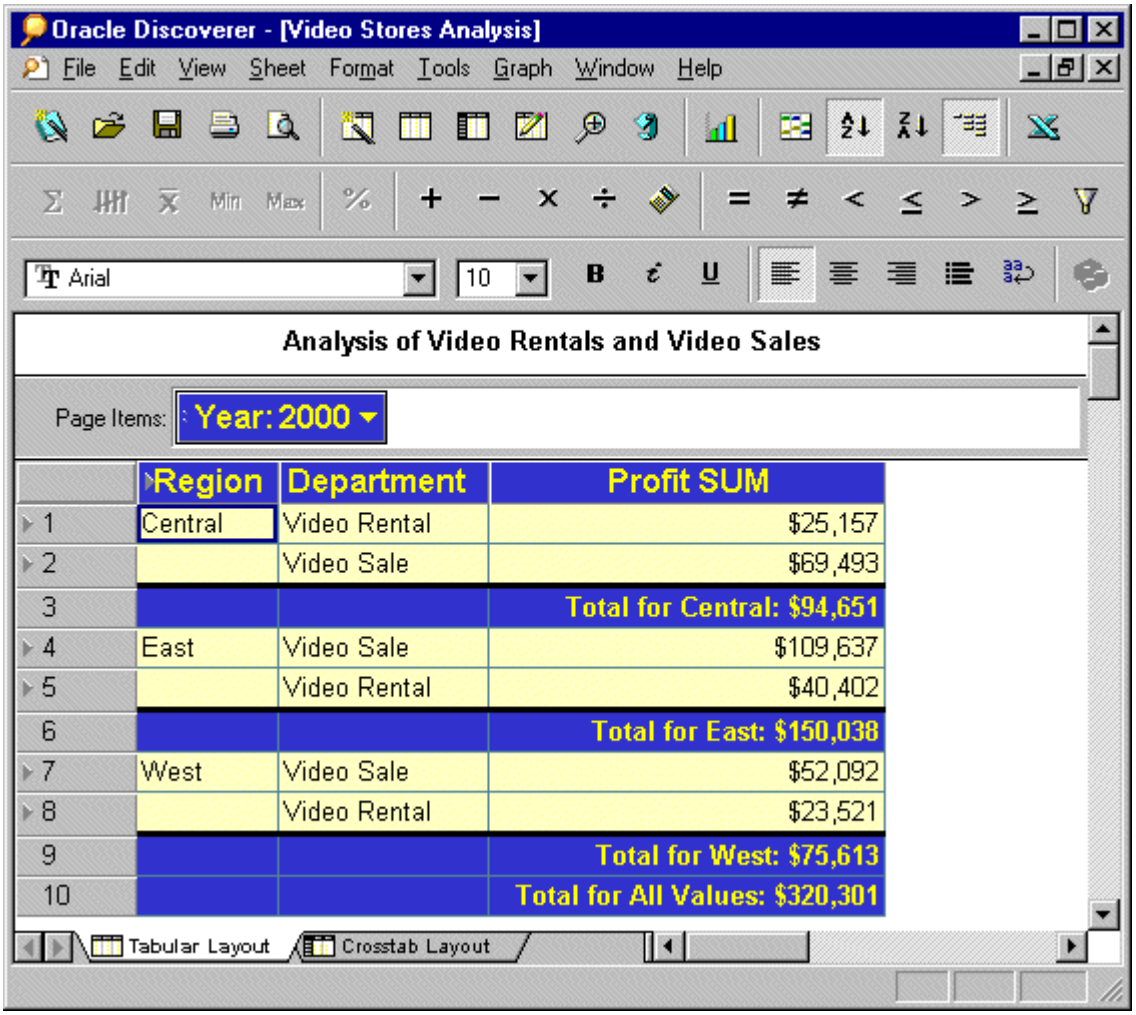


Figure 10 Workbook Wizard

Create a new workbook— starts the process to create a new workbook. This option is not available if you don't have access rights granted by the Database Administrator. See Chapter 7, "Building Worksheets and Workbooks" for details about creating a new workbook.

Open an existing workbook— shows options for opening one of your existing workbooks.

- Click Open an Existing Workbook. The next Workbook Wizard dialog box shows options for opening your existing workbooks:

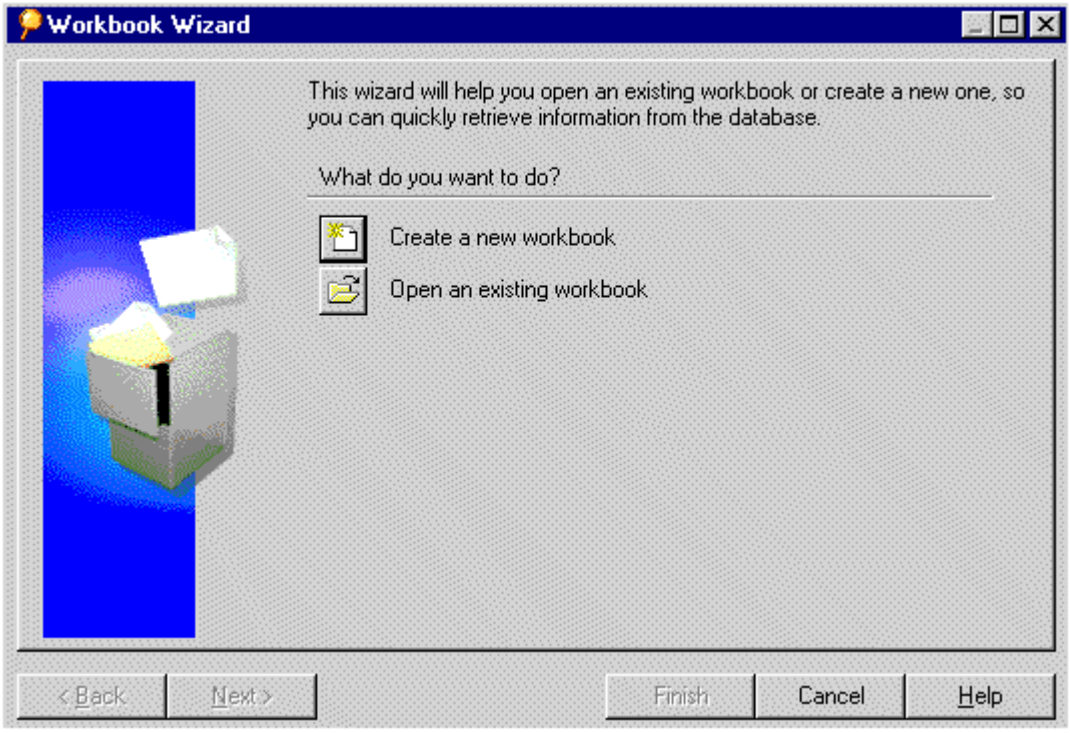


Figure 11 Opening an Existing Workbook

My Computer—opens a dialog box for selecting a workbook stored on your local computer or on a server on your business network.

Database—opens a dialog box for selecting a workbook stored as part of a specific database. The workbook can be shared easily with others who have access to the database. Scheduling

Manager—displays a list of workbooks previously scheduled to run at a certain time (usually overnight, on a weekend, or at some periodic interval). Scheduled workbooks run automatically and are available when you need to open them.

Recently Used List—shows the workbooks you've previously opened (see Figure 1–9 for an example). If you usually work with the same workbooks on a daily basis, this option is the quickest way to open a workbook.

If you choose My Computer from the Where is the workbook you want to open? options, a dialog box appears for you to select the workbook to open:

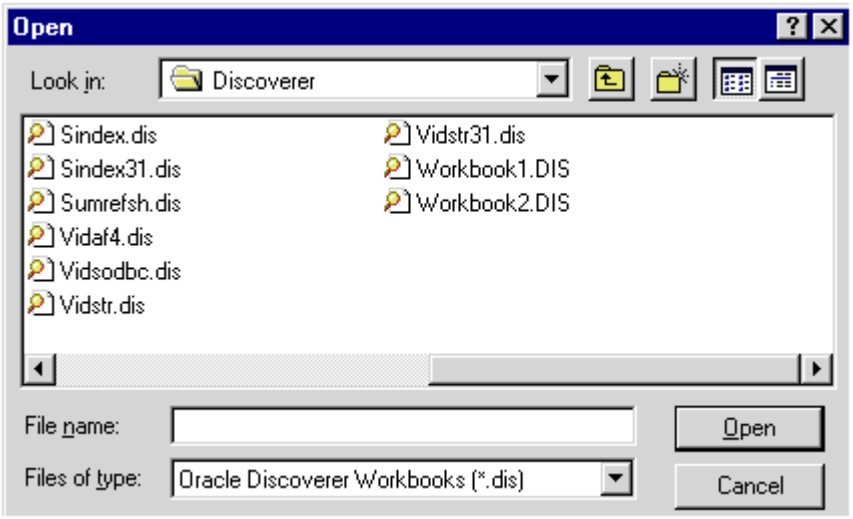


Figure 12 Select A Workbook to Open

- Select the workbook name and click Open, or just double-click the name. A dialog box asks if you want to run the query for the worksheet.

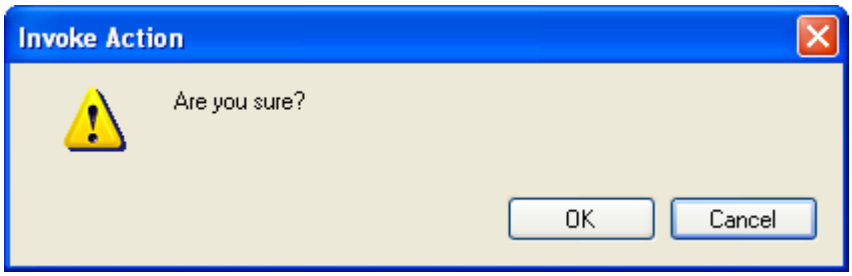


Figure 13 Query Confirmation

A query causes Discoverer to find the most recent data to fill in the worksheet. Normally you click Yes because you want to see the most recent data associated with the sheet. Click No if you don't want to see the data in the worksheet. For example, click No if you want to create a new worksheet and don't need to see the data on the existing worksheet.

- Discoverer now evaluates the query to determine how much time it will take to open the workbook and shows you an estimate. Click Yes to see the data.

This dialog box is mainly for convenience because, if the query time is more than a few minutes, you can be doing other work while Discoverer gets the data for the worksheet.

If you can't wait the estimated time, click No. Discoverer will remain open, but the worksheet will be empty.

If you click Yes, a dialog box shows you the progress and elapsed time while Discoverer is finding the data.

At the end of the process, your workbook appears. Here's a sample:

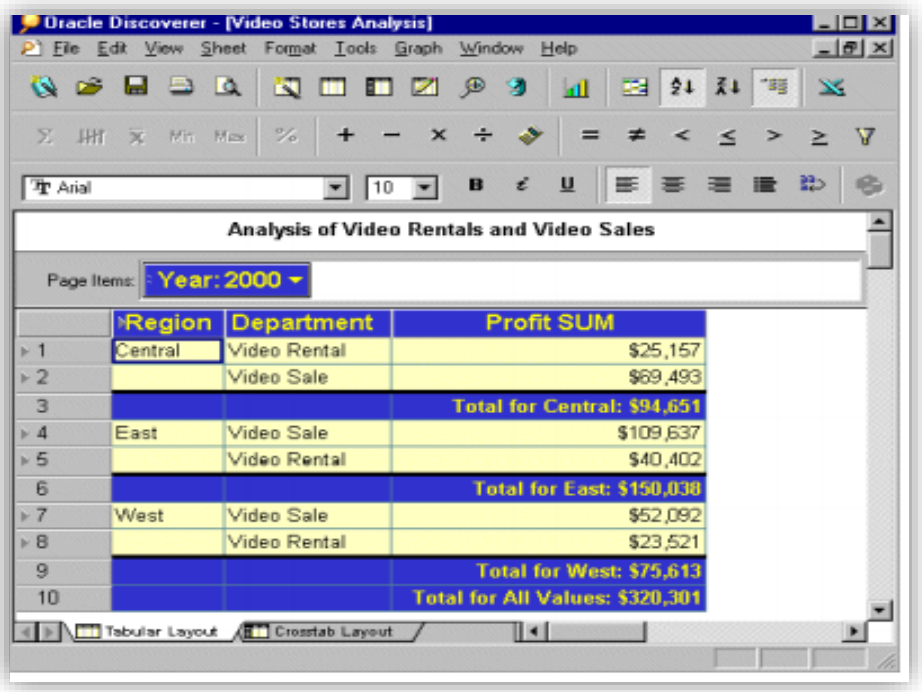


Figure 14 Discoverer Workbook

Saving a Workbook

Saving a workbook saves all of its changes. You have two options:

- To save a workbook, choose File | Save. The changes are saved and the workbook remains open.
- To close and save a workbook at the same time, choose File | Close. If you haven't made changes to any worksheet in the workbook, it closes

If the workbook contains any unsaved changes on any worksheet, a dialog box reminds you to save the changes.

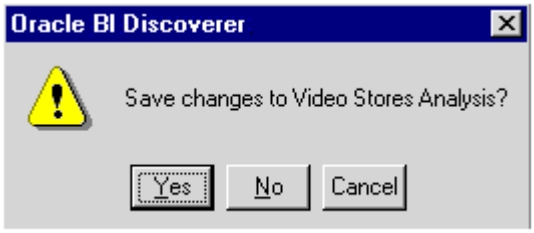


Figure 15 Save Workbook Reminder

Click Yes to save the changes; click No to close the workbook without saving the changes; click Cancel to keep the workbook open without saving the changes.

To save the workbook under a different name:

1. Choose File | Save As. A dialog box appears for you to specify where you want to save the renamed workbook.

2. Select an option from the Save Workbook dialog box and click Save.

My Computer—saves the workbook locally on your computer.

Database—saves the workbook with the database.

- If you select **My** Computer, the Save As dialog box appears (Figure 18). Enter a new name and click Save.
- If you select Database, the Save Workbook to Database dialog box appears and lists the workbooks already saved to the database (Figure 19). Enter a new name for the workbook and click Save.

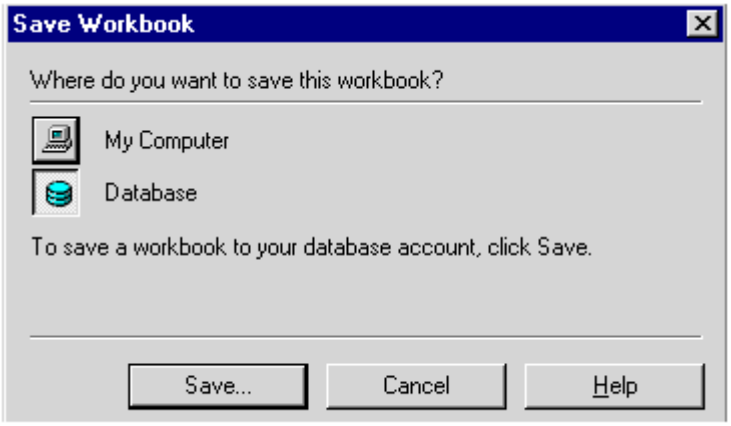


Figure 16 Where to save Workbook Dialog

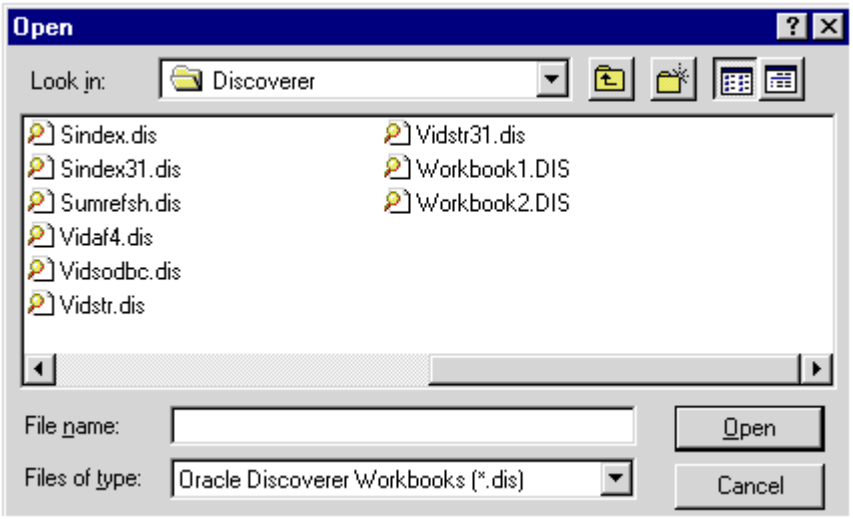


Figure 17 Save as Dialog Box

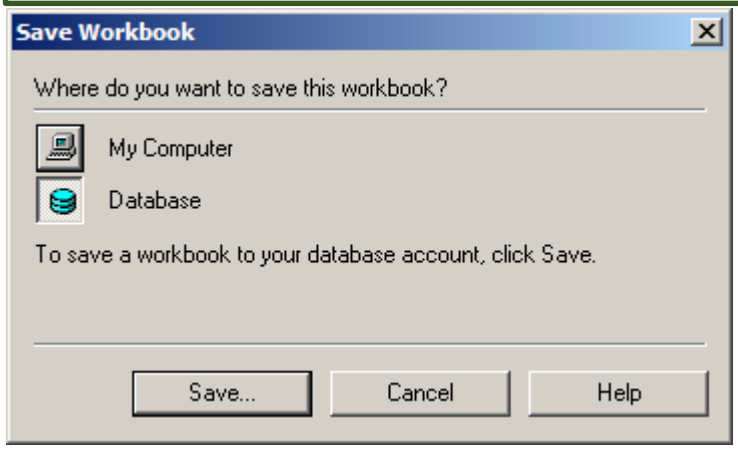


Figure 18 Save to Database Dialog Box

Deleting a Workbook

Deleting a workbook from the database permanently removes it.

You should not delete a workbook from the database unless you are absolutely certain that you won't need it in the future. To delete a workbook from the database:

21. Choose File | Manage Workbooks | Delete. The Delete Workbook from Database dialog box appears and lists the workbooks currently in the database.

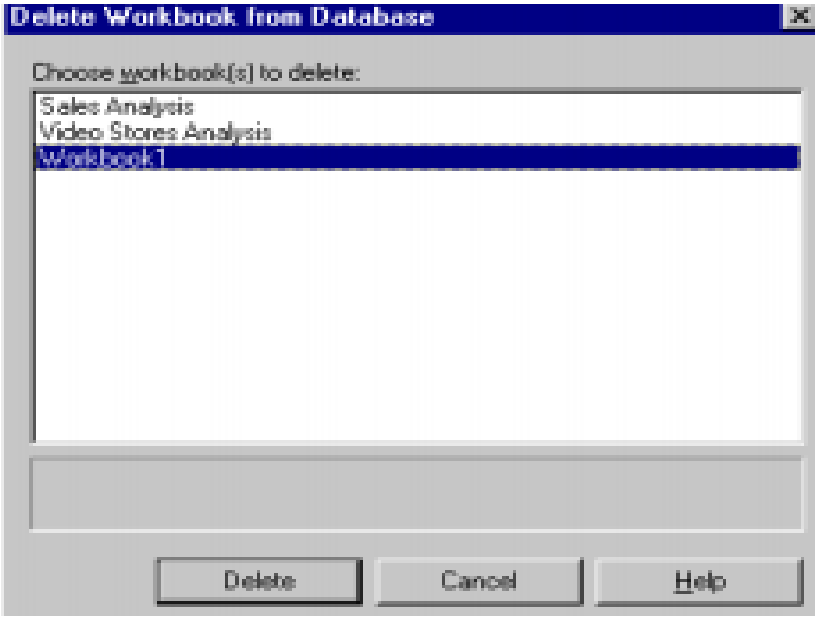


Figure 19 Deleting a workbook

22. Click the name of the workbook you want to delete, then click Delete.

Please Note: If you saved a workbook locally on your computer, deleting it removes it from your computer, but not from the database.

To remove a workbook from your computer, use Windows Explorer or the My Computer icon to remove the workbook as you would any other file.

Advanced Discoverer Features

Discoverer Desktop includes several advanced features for working with data. This chapter describes those features and explains how to use them. The advanced features are:

- Retrieving Rows and Counting the Number of Rows
- Creating Parameters
- Creating Calculations
- Creating Advanced Conditions
- Setting Options
- Using Command Line Options

- Importing SQL

I am going to discuss about the mostly used feature in the HR department and that is:

- The use of SQL

With SQL, we can analyze the SQL statements that Discoverer executes against the database and can also open workbooks with our own SQL programming statements.

The discoverer also has embedded SQL statements one can view.

To see a worksheet's SQL statements:

1. Choose View | SQL Inspector. The SQL Inspector dialog box appears. It shows the SQL statements used to create your current worksheet.

Figure 20 SQL Statement Dialog

2. Click Copy to copy the statements and paste them to another SQL program.

3. Click Export to export the statements to another file for use later with another SQL program.

4. Click OK to close the SQL Inspector dialog box.

Note: The SQL statements Discoverer uses to open a workbook or worksheet involves complex programming. Therefore, you cannot simply copy a worksheet's SQL and use it to open another workbook or worksheet. You must write your own programs.

Discoverer Execution plan

The Plan tab displays the Oracle Server Execution Plan chosen by the Oracle Server for a query request. The Execution Plan defines the sequence of

operations that the Oracle Server performs to execute the SQL statement. This facility is useful when using Summary tables and Materialized Views.

Summaries

Summary tables and Materialized Views store precomputed aggregated data, which is used where possible instead of data retrieved directly from the database. Because Summary tables and Materialized Views are much quicker to access, this enhances the performance of Discoverer.

Summary Management is handled automatically by Discoverer, and is transparent to most Discoverer users. However, you may wish to use the SQL Inspector feature to look at SQL statements being generated. For example, when using Summaries, you may wish to check that a query is using a Summary or Materialized View created by your Discoverer manager.

Types of Summaries

Summaries are created by your Discoverer manager to help do your work more quickly and efficiently. Two types of Summary used are:

- A Summary table is a table created by Discoverer.
- A Materialized View is the Oracle 8.1.6+ database server's own summary mechanism.

The Oracle software has a broad spectrum of feature to access, view, analyze data in the database and to produce reports thus, listing all would take more than usual pages but the most used features in the department are what I have listed above.

3.1.2 VIRDI BIOMETRICS SOFTWARE

Biometrics measure individuals' unique physical or behavioural characteristics to recognize or authenticate their identity. Common physical biometrics include fingerprints; hand or palm geometry; and retina, iris, or facial characteristics. Behavioural characters include signature, voice, keystroke pattern, and gait.

Of all these, fingerprint biometrics is the most developed. Of all the above, a biometric is the most secure and convenient authentication tool. It can't be borrowed, stolen, or forgotten, and forging one is practically impossible. Biometrics can be integrated into any application that requires security, access control, and identification or verification of people.

The fingerprint biometrics is used at E-process consulting, but you have to be registered into the database before the system can collate your clocking-in data daily.

Figure 21 Virdi Fingerprint Hardware

The fingerprint recognition hardware looks at the patterns found under your fingertip. There are a variety of approaches to fingerprint verification.

Some emulate the traditional police method of matching pattern; others use straight minutiae matching devices; and still others are a bit more unique, including things like "moiré fringe" patterns and ultrasonic characteristics. A greater variety of fingerprint devices is available than for any other biometric technology.

Here's a quick review on how the hardware works:

- Fingerprint systems translate illuminated images of fingerprints into digital code for further software such as enrolment (fingerprint registration) and verification (authentication or verification of registered users).
- The scanner uses an advanced CMOS image sensor to capture high contrast, high resolution fingerprint images that are virtually distortion-free.
- A series of powerful algorithms extract data from the image, mapping the distinguishing characteristics of the fingerprint.
- This data is then converted into an encoded binary string known as a digital template, and stored in a database. The actual fingerprint image is never stored. To identify or verify a fingerprint, a proprietary matching algorithm compares the new template made from the extracted characteristics from the input fingerprint on the optical module to a previously stored sample. The entire matching process takes roughly one second.
- Authentication takes place locally at the device or on a server, depending on system configuration

Identification vs. Verification Simplified

There are two primary functions offered by any biometric system and they are:

- **IDENTIFICATION:** a one-to-many (1 : N) matching process wherein a biometric sample is compared to a set of stored samples in a database.

- **VERIFICATION:** a one-to-one (1 : 1) matching process in which the biometric system compares an individual's biometric sample to previously enrolled data for that user. The process of verification narrows the biometric database search by including other identifiers such as names or IDs.

The terms "verification" and "authentication" are sometimes used interchangeably because both terms are used primarily to establish a specific user's validity rather than to identify users by querying an entire database of biometric samples.

"Authentication" Explained

Authentication is systematic method of confirming the identity of an individual.
Some methods are more secure than others. Simple authentication methods include user name and password, while more secure methods include token-based one-time passwords. The most secure authentication methods include layered "multimodal" biometric procedures. This is independent of authorization.

"FAR and FRR" Explained

Most modern biometric security systems can be fine-tuned to fit the needs of either high security or low security environments.

Increased security in biometric systems sometimes makes them more finicky, resulting in an increased **False Rejection Rate (FRR)** which is manifested when a registered user's biometric data (e.-g. fingerprint minutiae data) is rejected by the system. In these cases, emphasis on ambient lighting, climate, or user training may be needed as these factors affects the biometrics.

The net effect of FRR is usually nothing more than inconvenience to users. However, if security is set too low, the **False Acceptance Rate (FAR)** may increase. This is potentially far more serious, since it involves an

unauthorized person gaining access to protected resources. The **FAR and FRR** varies widely between biometric systems.

Biometrics Facts

- Fingerprint technology is NOT new! The commercial technology used by reputable products has evolved over the last 25 years, to the degree where through advances in technology and greater market acceptance, high quality scanners are now available at a far more affordable price.
- Fingerprints have been used as a form of identification for more than 200 years and are recognized as an acceptable form of identification by police services (AFIS) world-wide.
- Not all Biometric Readers are the same. Just like any other product, you get well designed product, manufactured with high standards and then on opposite side of the spectrum, you get poorly designed and poorly produced technology.
- Not all Biometric scanners are equal. There are also many variations of Biometric technology (Finger Scan, Iris, Face, and Hand Geometry), each variation has been designed for a particular application.
- Optical Finger Scanners are the predominant technology in the Biometric Time and Attendance market. The durability and the ease of use of these devices make them ideal for all applications.
- Not all Biometric algorithms are the same. An algorithm is a formula used to calculate the characteristics of a scanned image and search for the best match. Well-designed algorithms, give you accurate search facilities at high speed.

Why our company uses Biometric Technology in place of Traditional ID cards

- To eliminate “buddy clocking“, where one employee clocks for two or more staff members.
- To save additional costs involved in issuing ID cards.
- To validate for security or health and safety reasons, that the correct person, with the correct skill and personal profile has access to your site.

- Use of contract/seasonal labour and cannot always ensure the ID cards will be returned.

When Biometric Technology Fails

- ✓ Biometric Technology is not the answer for every type of industry, when it is used in the right application, it works perfectly. However, in some businesses, it will never work. The main issue to consider is whether or not your staff's fingerprints remain consistent.

- ✓ When you enroll a finger on the system, a master file image is stored. Thereafter, every time that finger transacts, the system compares the current image against the master file image. If there is a difference, then the system will NOT accept that transaction.
  Therefore, a builder who is laying bricks will not be consistently read by the system, as the characteristics of the finger change on a daily basis due to damage to the physical characteristics of the finger.

- ✓ Exposure to abrasive surfaces, glues, solvents, powders, cement, excessive moisture and cut/damaged fingers all constitute environmental issues which are detrimental to the success of a Biometric installation.

- ✓ Some people genetically have difficult to read fingerprints, aspects, such as, extremely dry or extremely moist fingers, small fingers or previous exposure to harsh chemicals all affect the enrolment and future success of biometric transactions.

To get immediate benefits from a Biometric device, there are numbers of important issues to consider such as:

1. User education is paramount to ensure the success of the installation.

2. The first-time enrolment of your staff rarely results in the best master file image. The reason for this, comes down to user education, if the staff member does not consistently place their finger on the scanner during the enrolment, the master file will not have an accurate template to compare each future transaction against.

3. Your staff need an opportunity to experiment with clocking/transacting on a Biometric Scanner; this will build their confidence levels, as well as improve their enrolment / transaction technique.

4. A future re-enrolment of the master file image will result in improved transaction performance, both in speed and the false rejection rate.

The virdi biometrics system proved to be an exceptional hardware in the concept of fingerprint biometrics, therefore any organization with a plan of implementing a new biometric system should follow the following guidelines:

1. The location of the reader must be identified taking cognisance of the following issues:

- ✓ The fingerprint scanner should not be exposed to direct sun light or harsh industrial lighting, this may result in an "over exposed image" (like a photograph).

Please note: the position of the sun changes during the day and also changes between seasons (summer high on the horizon, winter low on the horizon).

- ✓ The floor surface must be flat and level.
- ✓ There must be sufficient elbow room for the users to transact in a natural fluid movement.
- ✓ The reader should be mounted at a height of 1.5m, it is better for the reader to be mounted higher rather than lower.
- ✓ The reader must not be exposed to moisture, i.e. rain, mist, high humidity or water spray unless it has a weather-proof or IP65 rating.

2. The users must be properly trained, this involves:

- ✓ Informing the users of the plan to implement a biometric system.
- ✓ Correct demonstration how they are to transact on the system during the enrolment phase.
- ✓ Correct demonstration how they are to transact for the clocking IN and OUT procedure.
- ✓ Instructing the users on the issues which will result in a "failed" transaction.

3. The users must feel comfortable with the technology, the following practise assists with this process:

- ✓ Educate the users.
- ✓ Take your time with enrolment.
- ✓ Consider a re-enrolment at a later stage.

4. Look out for the following tell-tale problem signs:

- ✓ Employees who do not get a high enrolment score.
- ✓ Employees who have particularly small fingers, you will notice that the scanner is not covered. – Try and use a thumb.
- ✓ Employees who have thin fingers, you will notice that the red LED light penetrates the finger. – Ask the user to place one finger on top of another (cross fingers).
- ✓ Employees who do not have clearly defined fingerprints.
- ✓ Employees with particularly dry skin. – This is an indication of poor health, the employee should seek medical treatment, however the use of a moisturiser or oil from the forehead does help.
- ✓ Employees who arrive with clean hands and end their day with exceptionally dirty or damaged hands.
- ✓ Employees who work in wet environments and end the day with wrinkled fingers.

3.1.3 IP NETWORK UTILITIES

1. **PING:** Ping is an acronym for Packet Internet Groper which is a standard software utility (tool) used to test network connections. It can be used to determine if a remote device (such as Web or Game server) can be reached across the network and, if so, the connection's latency.

   Ping tools are part of Windows, Mac OS, and Linux as well as on some Routers and Game consoles. 33 Most ping tools use Internet Control Message Protocol ***(ICMP).*** They send request messages to a target network address at periodic intervals and measure the time it takes for a response message to arrive. The name comes from active sonar terminology which sends pulse of sound and listens for the echo to detect objects under water.

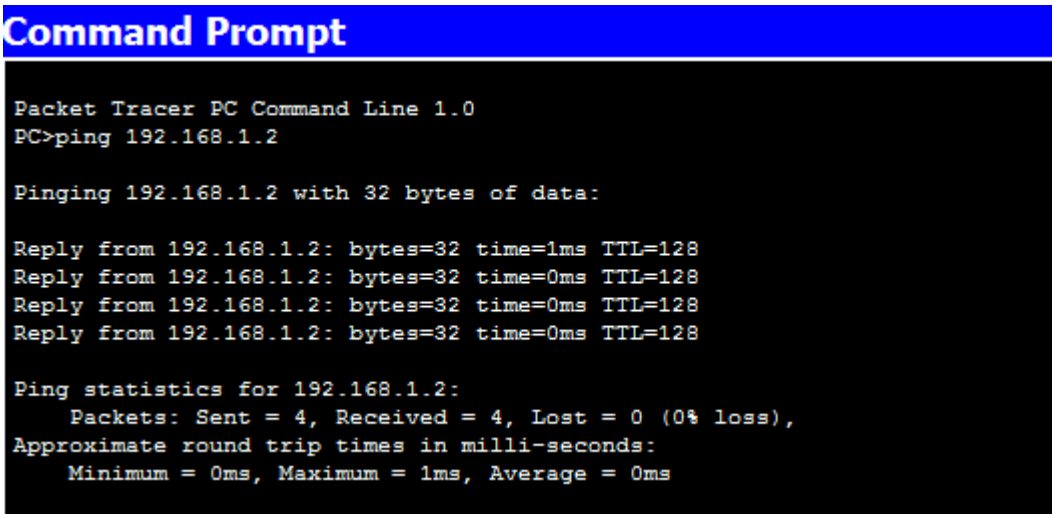


Figure 22 Ping Pattern

2. **TELNET:** Telnet is a user command and an underlying TCP/IP protocol for accessing remote computers, through telnet an administrator or another user can access someone else's computer remotely. On the web, HTTP and FTP protocols allow you to request specific files from remote computers, but not to actually be logged on as a user of that computer. With Telnet you log on as a regular user with whatever

privileges you may have been granted to the specific application and data on that computer. A telnet command request looks like this: 34 Telnet howtogeek.com.edu The result of this request would be an invitation to log on with a user-id and a prompt for a password. If accepted, you would be logged on like any user who used this computer every day.

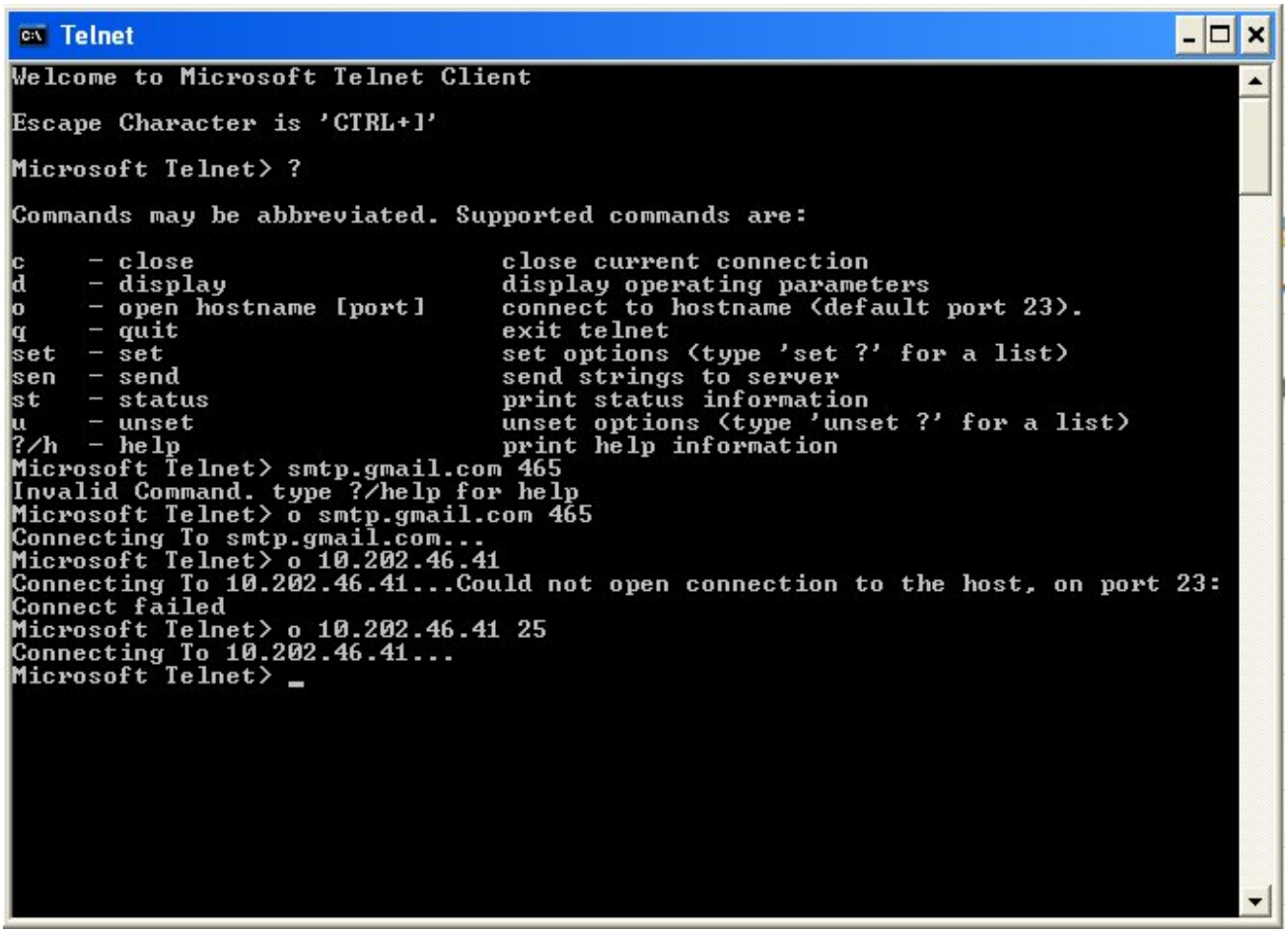


Figure 23 TELNET Pattern

3. **IPCONFIG:** In computing ipconfig (Internet Protocol Configuration) in Microsoft Windows is a console application that displays all current TCP/IP network configuration values, can refresh DHCP (Dynamic Host Configuration Protocol) and DNS (Domain Name System) settings. This utility can be used to obtain information for each IP network interface for the host, for example, DNS hostname, IP Addresses of the servers,

   physical address of the network card. It's also used to renew an IP address with a DHCP server.

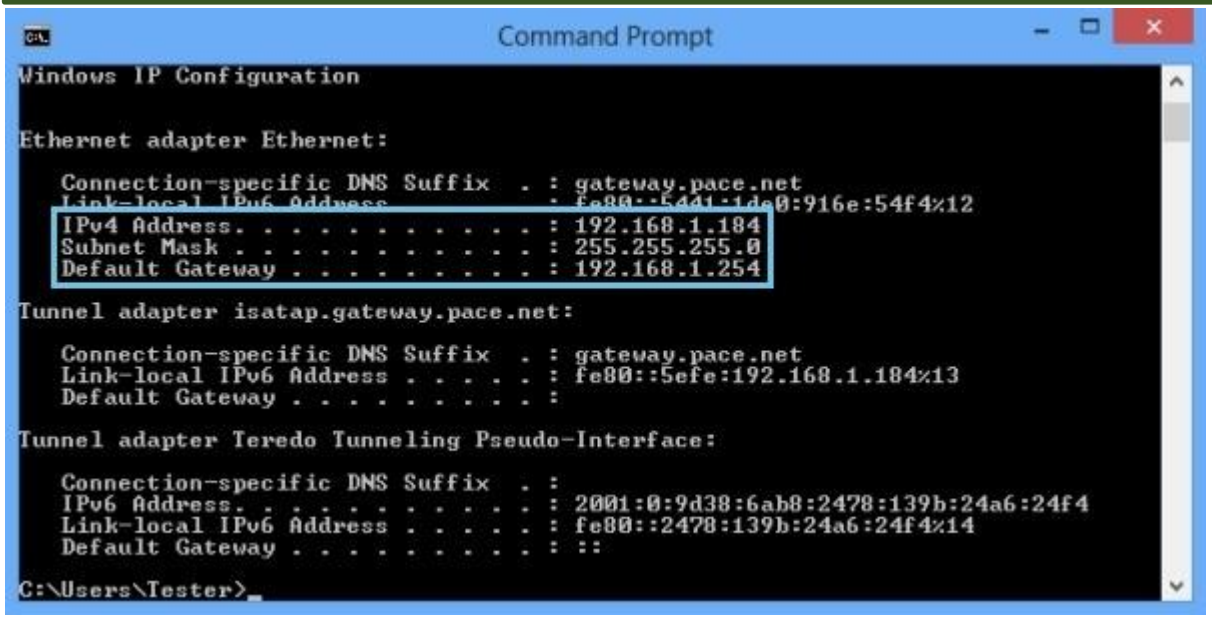


Figure 24 IPCONFIG Pattern

CHAPTER 4

CONTRIBUTION TO THE ESTABLISHMENT

I was designated to the ERP section and also to the CTO department (Technical Leadership Section) to assist the team with my knowledge on AI (Artificial Intelligence) and to assist the establishment in ways they can implement AI to reduce cost and improve customer satisfaction through seminars.

4.1 OVERVIEW ON AI (ARTIFICIAL INTELLIGIENCE)

I discussed with the team the difference between AI, Deep-Learning, and Traditional ML. Explaining these terms above goes as follows:

2. AI: "The term AI is inspirational, a moving target based on those capabilities that humans possess but machines do not" – Zachary Lipton, Assistant Professor at Carnegie Mellon.
3. Deep-Learning: This is an algorithm that uses multilayered neural networks and a vast volume of data to work.
4. Machine Learning: ML are algorithms that learns from data and requires only little amount of data to function unlike Deep-Learning.

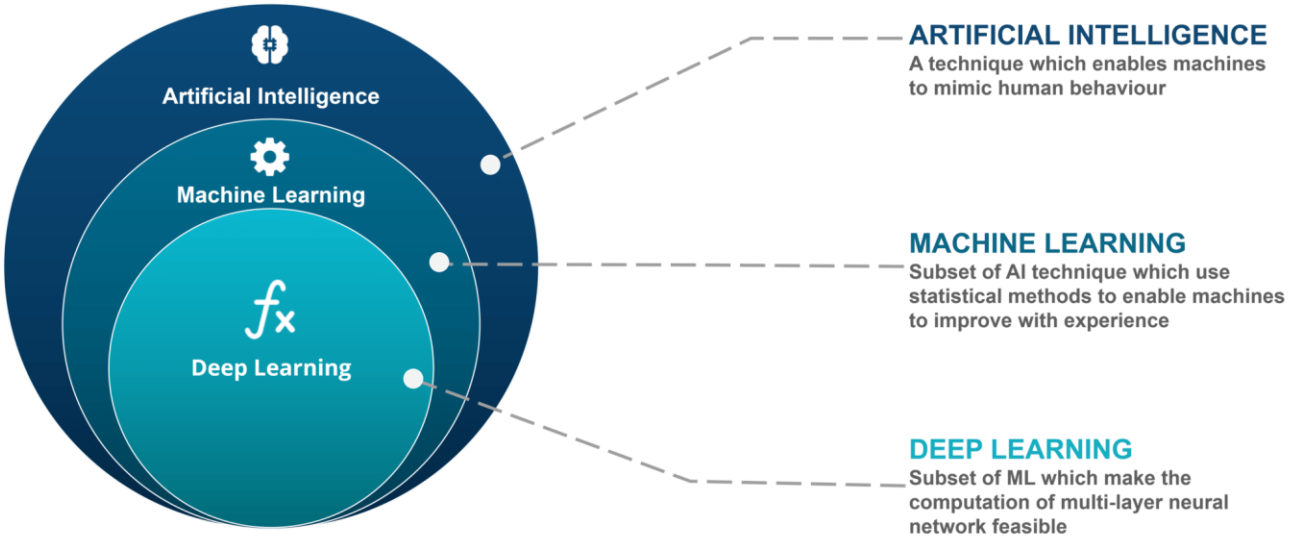
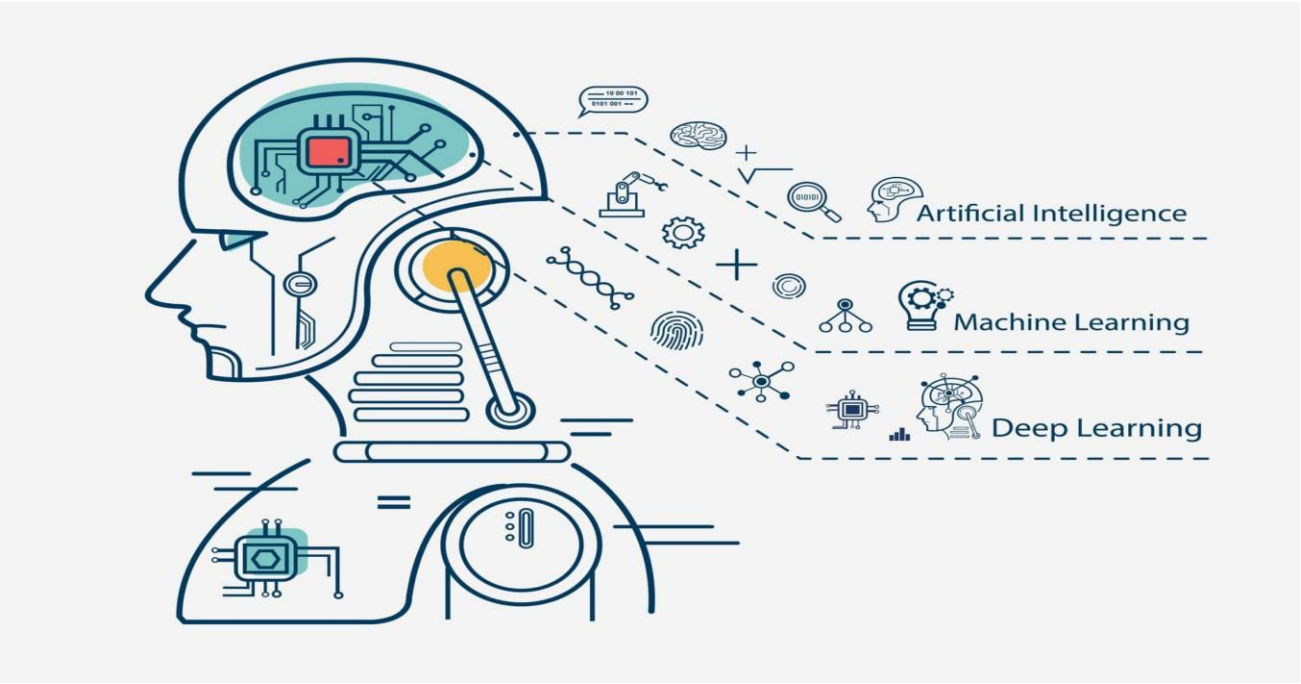


Figure 25



In relation to the implementation of AI Computers with higher computational speed is required for better performance, for example super computers are the maximum requirements and their computational speed uses the metric "FLOps" (Floating Point Operations) from storing text to doing multiplications.

FlOps = Calculations per second

Kilo-FLOps (1 x 10^3)

Mega-FLOps (1 x 10^6)

Giga-FLOps (1 x 10^9)

Tera-FLOps (1 x 10^12)

Peta-FLOps (1 x 10^15)

Exa-FLOps (1 x 10^18)

In a world where data is increasing to 175 Zata-bytes many Tech companies are claiming to break the Exa-FLop Barrier in 2021, for example intel says it will be first with Aurora in 2021, while AMD and Cray claim they will be first with Frontier.

An exaFLOP is one quintillion (10^{18}) floating-point operations per second, or a1,000 petaFLOPS.

To match what a one exaFLOP computer system can do in just one second, you'd have to perform one calculation every second for 31,688,765,000 years.

4.2 INDUSTRIAL APPLICATION OF AI

AI has improved labor productivity and product enhancements. Looking at targeted sectors of the industry:

1. E-commerce:
   - Retail- Pricing and Promotion, Customer Service management.
   - Consumer goods- Supply chain managing, Demand forecasting.
   - Finance- Marketing and Sales, Assessing and Managing risk.

A case study is: the "blue rivers" AI technology installed in tractors assist farmers in reducing herbicide usage by 90%, identifying subtle differences between crops and weeds and spraying only weeds saves costs for farmers.

Using COMPUTER VISION and AI this smart machines can detect, identify and make management decisions about every single plants in the field.

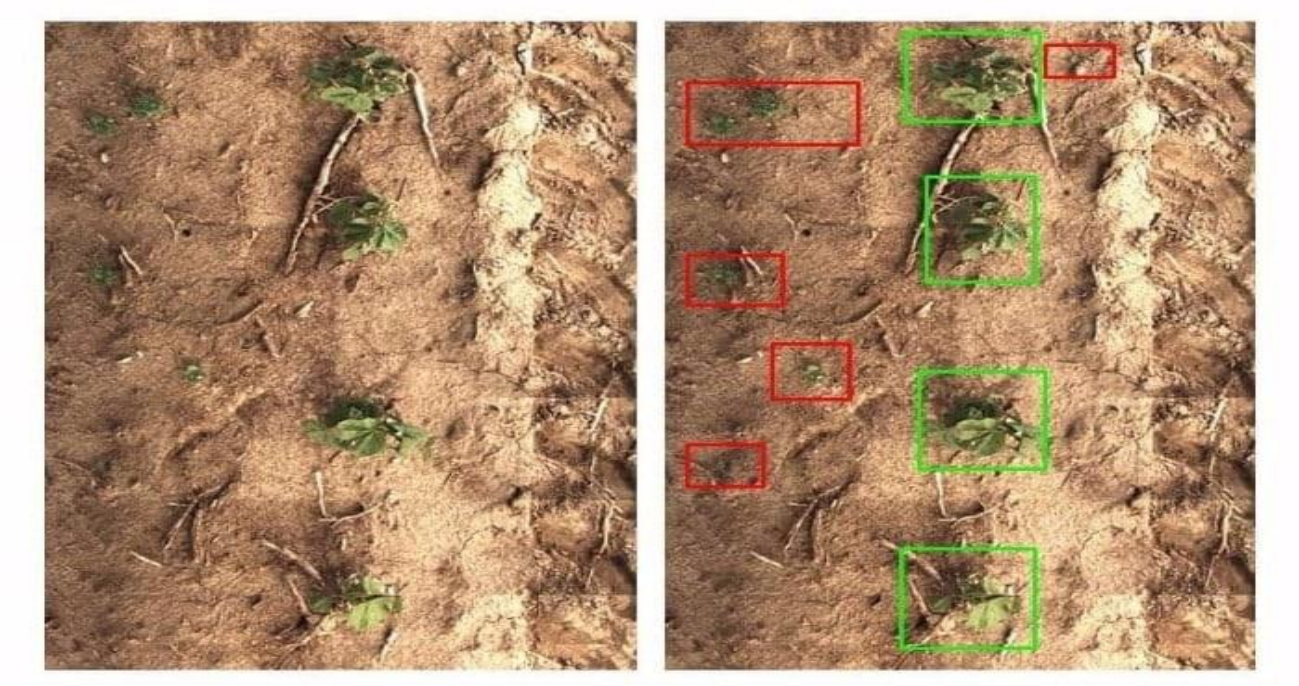


Figure 26 ***Blue River TECH***

4.3 MACHINE LEARNING TECHNIQUES

There are 3 approach to ML these are:

1. Supervised Learning:
   - Classification
   - Regression
2. Unsupervised Learning:
   - Clustering
   - Association
3. Reinforcement Learning:
   - Real-Time
   - Offline

Supervised learning uses prelabelled data to train a model to predict new outcome for information that it hasn't been exposed to before and maps an input to and output, some use cases of supervised learning are:

- Face Detection
- OCR
- Image Classification
- Sentimental Analysis on social media
- NLP
- Audio Transcript
- Even Detection

Unsupervised learning uses un-labelled data and self organizes to predict patterns or outcomes. Use cases of unsupervised learning are:

- Ecommerce Websites: Used to determine clicked path customers take to add a product to cart or purchase a product (AKA Search Relevance).

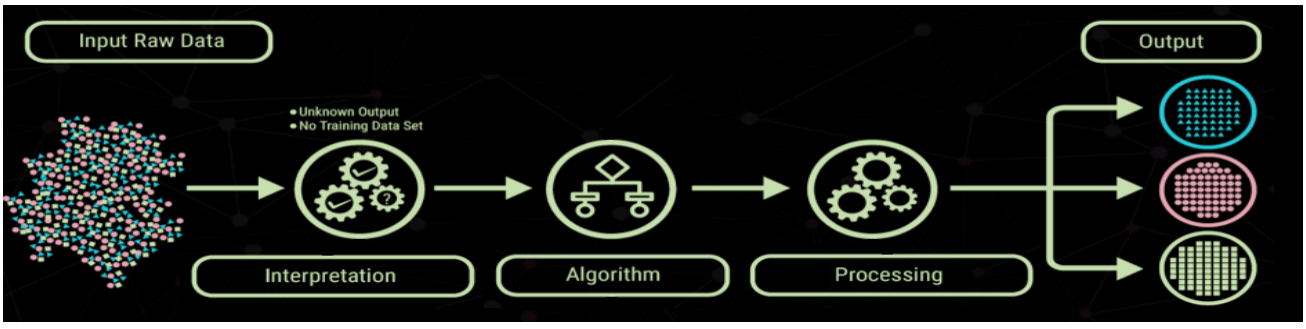


Figure 27 Unsupervised learning

Reinforcement learning is simply an act of giving feedback to an algorithm whether it is right or wrong based on discreet outcomes.

Supervised vs unsupervised learning

	SUPERVISED LEARNINING	UNSUPERVISED LEARNING
CONTINUOUS	CLASSIFICATION	CLUSTERING
DISCREET	REGRESSION	DIMENSIONALITY REDUCTION

Machine Learning PIPELINE

A typical approach to AI starts with the data.

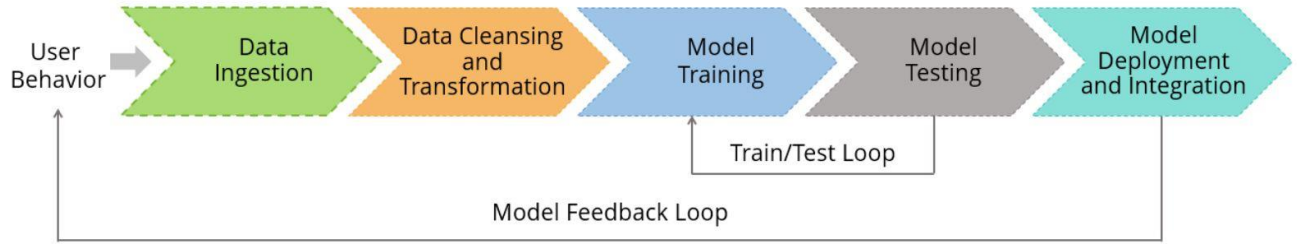


Figure 28 ML Pipeline

4.4 IMPLEMENTATION OF AI IN THE ESTABLISHMENT

Start with the problem

Business problem → Data → Model Building → Deploy and Measure → Active learning and Fine Tuning

Active learning means a model can learn from data that is labelled by human annotators and experts.

Therefore, when a model does not know the answer to a query or certain input, more data must be gathered from the outside world or annotators and then the model is retrained to increase its knowledge base and confidence of the model.

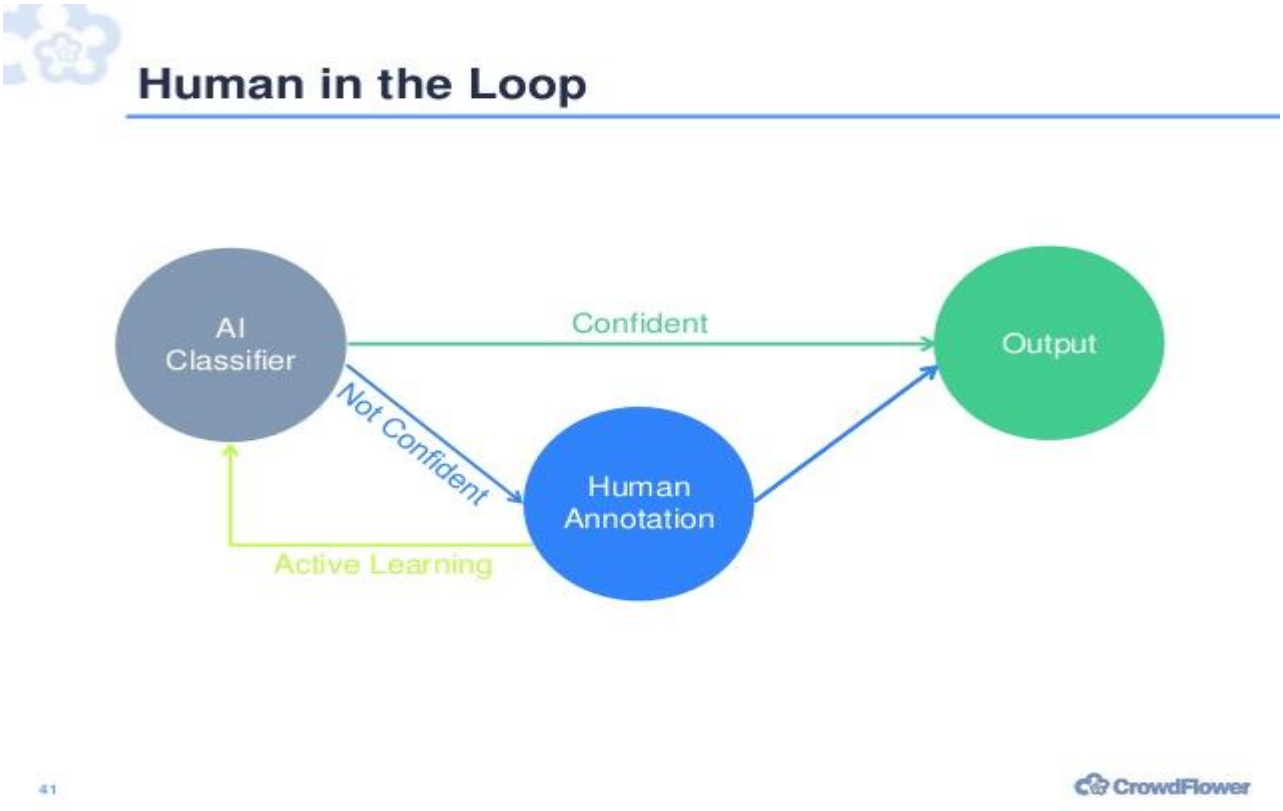


Figure 29 Active Learning

NOTE: Before the implementation of active/continuous learning the AI Manager should put the following thought-provoking questions int consideration:

- Does the business warrant solving?
- What problem are we solving?

- How does AI solve the problem?
- Does the problem have large volume of data?
- Can I quantify business value clearly and simply?
- What data are needed?
- How much data do I have?
- Does the dataset match the problem?
- Is It complete?
- Is the data annotated correctly for the ML team?
- How do I measure success? Users can find the best quality product quickly.
- What metrics is used to measure success?

For example, when I need to do something for marketing collateral I want to make sure that I select the best option based on all variables so I can improve advertisement conversion and sales.

Narrowing the business problem

Take for a use case an image search on a product for a business website, we break down the business problem by:

- ✓ Improving site conversion
- ✓ Improving the search results
- ✓ Improving click-through on the top 10 search results returned
- ✓ Improving the percentage of hero images which feature the products

Measuring success

In measuring success metrics are used and before considering success metrics to be used the following are to be considered:

- ✓ Metrics should be easily measurable
- ✓ Metrics should correlate with the business problem
- ✓ Metrics should predict business outcome
- ✓ Metrics should be isolated to factors controlled by the group its measuring
- ✓ Metrics should be comparable to competitors metrics

58% have considered AI but only 12% have put AI into practice.

Different industries have different business goals, once we have a business goal we then refine and revisit the success metrics such as:

- Customer experience
- Revenue gain
- Customer engagement
- Business process automation
- Better and faster decision making

4.5 CREATING A DATASET

Data fit and Annotation

To ensure data fit:

- ✓ Use production data to ensure the training data matches the real world scenarios
- ✓ Determine the success criteria for a trained model:
    1. Precision
    2. Recall
    3. F1 Score
    4. If criteria is not met then, retrain and go back to the data

$$(10.1)\quad Accuracy = \frac{T_p + T_n}{T_p + T_n + F_p + F_n}$$

$$(10.2)\quad Precision = \frac{T_p}{T_p + F_p}$$

$$(10.3)\quad Recall = \frac{T_p}{T_p + T_n}$$

$$(10.4)\quad F_1 = 2 \cdot \frac{precision \cdot recall}{precision + recall}$$

With respect to annotation, data annotation/model should be updated regularly according to the changes in the underlying data.

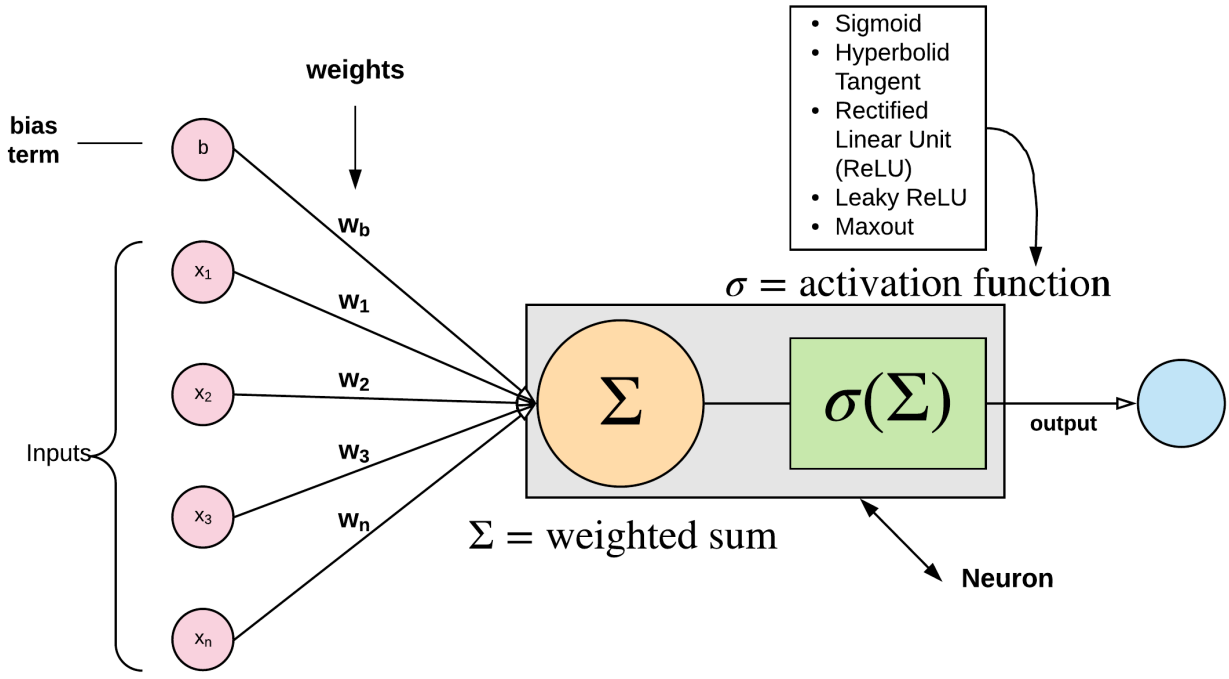
Modelling and ML consists of constructing the core components that will serve as the framework for a ML model. Neural networks are some of the most common model used in ML.

4.6 NEURAL NETWORKS

- ✓ First developed in 1950s
- ✓ A series of computational layers
- ✓ Specialized nodes performs various computations
- ✓ Predetermined network architecture

The structure of these nodes and layers as well as how they are connected is what is known as the architecture of the network.

Activation Functions



Activation function (sigma) ranges from -infinity to +infinity, this further shows that the neuron knows no bound.

Now, the question is how can we say the neuron is fired or not?

To do so we create a step function, if the threshold value is then assigned we can say that:

Activation function = "activated" if Sigma > threshold else not

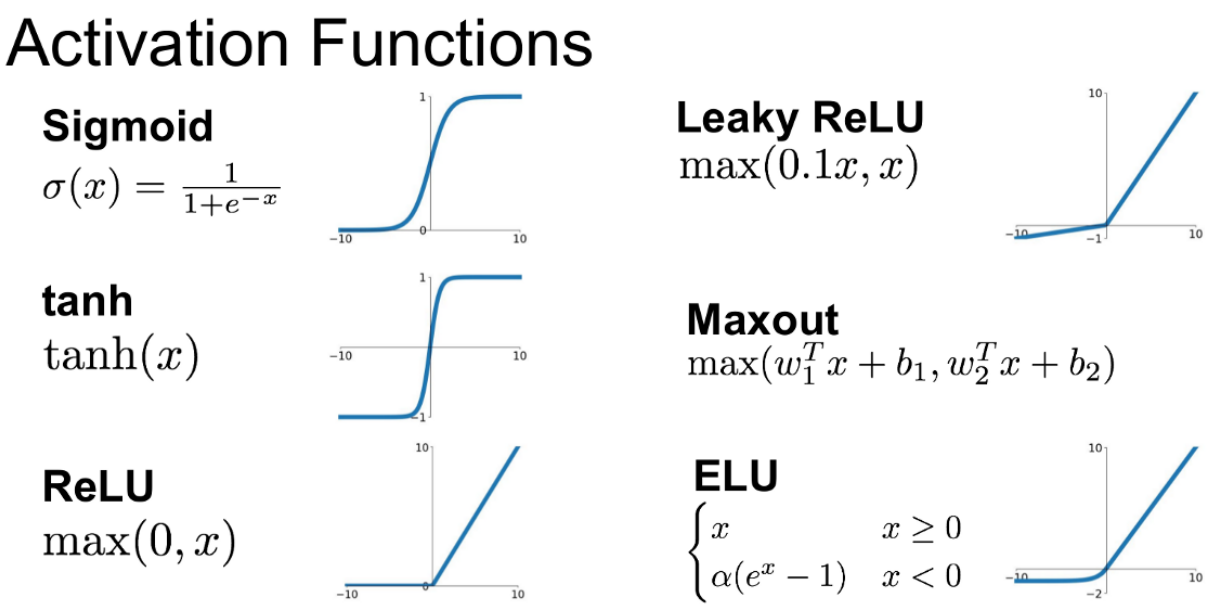
Alternatively,

Activation function = 1 if Sigma > threshold otherwise 0

Activation functions are functions that we can use as decision boundaries to tell whether/not to send a signal to subsequent nodes in the network.

It passes continuous boundaries to pass on information.

Sigmoid function, ReLU and Leaky ReLU functions



The sigmoid function is continuous and returns a value ranging from 0 to 1, while the ReLU simplifies the Activation Function to linear form so as to make the training easier. We do not need to pay attention to the -ve inputs which reduces the number of nodes that are activated thereby simplifying the network.

The ReLU gives less significance t -ve values but to numbers above 0 and below 0.

4.7 BUILDING THE MODEL

If a model is given an unknown data(image) to identify, it will predict the data based on the training data and give the right data

When giving the model a new data to identify, we should train the model on the new class to infer on the new data, diverse set of data is used to build a robust model.

Training data is used when a model is learning, then after training we use the testing data to see how our model would perform on new inputs.

Transfer Learning

This involves using the knowledge from an already trained network with the similar use case and adapting that to a new use case with different classes.

OR

It is the transfer of a learning from earlier layers of one network to another.

Note:

- ✓ Transfer learning uses knowledge from previous models
- ✓ Pretrained models are found online for use with transfer learning
- ✓ Automated ML makes it easier to create models
- ✓ For more complex models a custom developer may be required

Outcome vs Output

Outcome	Output
➢ Generate revenues ➢ Improve customer experience ➢ Increase user satisfaction ➢ Automate and save cost	➢ Accuracy ➢ Execution time ➢ Recall ➢ Precision

Outputs are success metrics and they should be given little attention unlike the outcomes.

Chatbot Example

Measure, learn and evolve your chatbot.

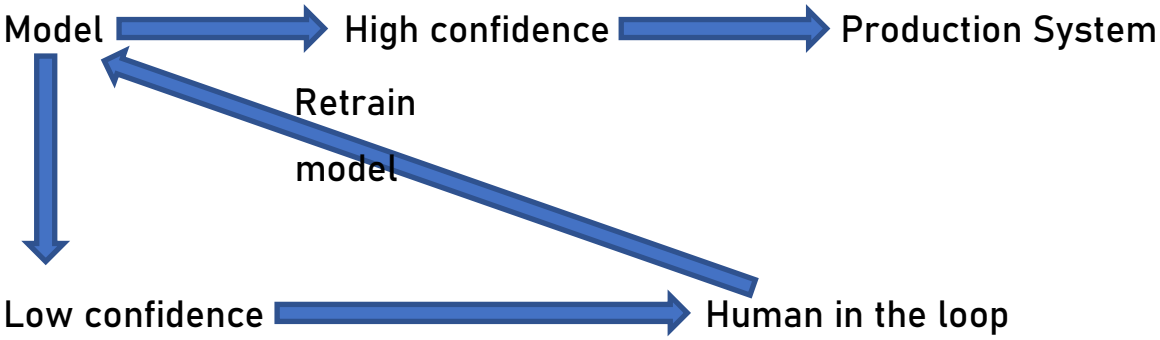
- User adoption and retention
- User engagement
- Conversation rate
- Self-service rate
- User satisfaction

A/B Testing and Versioning

What to consider:

- ✓ Cost benefit analysis: is x% accuracy gain beneficial for business
- ✓ What if this slightly better model requires a much larger investment
- ✓ Run test long enough to capture seasonality effects
- ✓ Control the experiment to avoid "novelty effects" initial +ve effects that wears off

Continuous Learning



After the seminar the team and I worked on various projects to improve the establishments popularity in the IT-Sector and also to improve customer satisfaction and they were very pleased for the insight I shared with them.

Apart from the seminars I also:

- Configured wireless routers
- Troubleshot wireless adapters
- Maintained wired cables

CHAPTER 5

OBSERVATIONS

As a student my first observation was the cognition of the difference between the school environment and the labor market, as it is a different ball game entirely.

I also observed that safety was paramount and it could easy be seen as the primary goal of every staff of the company and not only the technicians during this COVID-19 pandemic. As safety equipment and instructions were always put in place or made available at strategic locations within the company.

Neatness was also a key attribute, staffs were always admonished to be as neat as possible in their dressing and in carrying out their duties. This was further encouraged by rewarding anyone that could fully adhere to this:

- The hospitality shown to customers was of another level as customers were treated with so much care and respect. From provision of free breakfast and lunch, to a brief internal training, to free medical checkup the customers were always made to feel at ease.
- Communication played a vital role in the successful execution of jobs, from among personnel in a section to departments communicating with other departments present in the company and also customers with company's personnel. Good flow of information was required and as a result most jobs that were returned or problematic, come about as a result of poor communication between parties.

CHAPTER 6

CONCLUSION AND RECCOMENDATION

6.0 CONCLUSION

My 6months industrial attachment at E-process Consulting was a huge success and a great time of acquisition of knowledge and skills. Through my training I was able to appreciate my chosen course of study even more, because I had the opportunity to blend the theoretical knowledge acquired from school with the practical hands-on application of knowledge gained here to perform very important tasks that contributed in a way to my productivity in the company.

My training here has given me a broader view to the importance and relevance of Computer Science in the immediate society and the world as a whole, as I now look forward to impacting it positively after graduation.

I have also been able to improve my communication and presentation skills and thereby developed good relationship with my fellow colleagues at work. I have also been able to appreciate the connection between my course of study and other disciplines in producing a successful result.

6.1 RECOMMENDATION

I use this means to make the following recommendations concerning the training of students in Industrial Attachments

1. Allowances should be paid to students during their programme just like NYSC and not after. This would help them a great deal to handle some financial problems during their training course.

6.2 CHALLENGES ENCOUNTERED DURING PERIOD OF TRAINING

I had to wake up earlier to beat the traffic at mile 12 and ojota so that I could reach my work place before 7:30am, and after closing hours at 4pm I would

get home at 11pm or even 12am, it was not an easy experience at all. Apart from that the transport fare during the pandemic flared up making me to cut down my feeding expenses.

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