SPECIAL FEATURE

Maximum Powerpoint Tracking of Solar Cell using Boost Converter & it's Fuzzy Logic Controller Application.

Silicon Tech

The Science & Technology Magazine

Digital Digest

Vol. 29 • April-June 2023

Our Vision: "To become a center of excellence in the fields of technical education & research and create responsible citizens"

Sand Battery

Currently renewable energy systems are used to meet the increasing power demand with energy storage devices which are used to provide the backup power when grid cannot meet the peak demands. Energy storage systems help in increasing the grid efficiency. Mostly lead acid, Li ion batteries are used in grid integrated with renewable energy systems or remote/off grid locations.

Presently a technology developed by a Finnish Company Polar Night Energy known as "Sand Battery" is used to store energy for months. The two founders of this company Tommi Eronen and Markku Ylonen think this will help the grid to effectively shift from conventional system towards renewable energy systems. Finland has installed the first commercial sand battery in the city of Kankaanpaa. This technology uses sand or sand like materials as its storage medium based on high temperature thermal energy storage. With this technology the storage can be effectively enhanced. The working of sand battery involves heating of sand in heat transfer pipes inside an insulated steel housing heated at a temperature of 600 degrees Celsius. This sand is an effective medium of storing heat for a long time. The other components include heat exchanger or steam generator. The electricity generated by conventional methods using fossil fuels or renewable energy is used to charge the sand. The closed air pipe arrangement is used where the air gets heated up by electrical resistors and is circulated by heat transfer pipes. It stores energy in the form of heat and can be used back as electricity by steam turbines. Also the heat can be obtained by blowing cool air through the charge, by air-heat exchangers.

This provides a clean storage solution without polluting the environment. Another advantage is sand remains hot for long period of time. The size of sand particles also doesn't affect its operation. So the sand battery installed by this Finish Company uses coarse sand or products not suitable for construction companies. Hence this allowed this company Polar Night Energy to commercialize large scale energy storage. This battery can work in winters as the sand is present inside the insulated silo. The battery is charged at night or when electricity prices from grid are low or by intermittent renewable energy sources.

"Its main purpose is to work as a high-power and high-capacity reservoir for excess wind and solar energy," Markku Ylonen, Polar Nigh Energy's co-founder and CTO, says in a statement. "The energy is stored as heat, which can be used to heat homes, or to provide hot steam and high temperature process heat to industries that are often fossil-fuel dependent."

The first commercial installation in western Finland comprises of a 23 ft tall still housing with 110 tons of sand. This battery when fully charged stores 8 megawatt hours of thermal energy and 200 kilowatts of power when discharged through the pipes, enough for 100 homes. The sand battery technology can be used to provide a clean energy storage solution as well as can fill the gap between the grid and energy storage systems. It also provides an economic solution as it is ten times cheaper in comparison to Li ion batteries for storing the same amount of energy.

Dr. Lopamudra Mitra
Dept. of EEE

Maximum Powerpoint Tracking of Solar Cell using Boost Converter and it's Fuzzy logic Controller Application

Abstract : *The clean and silent nature of producing power through solar cells has made the evolution of Photovoltaic (PV) power generation as one of the premier mode of power generation globally. The efficiency of the PV plant is a major concern as it depends mainly on the functioning of PV Panel, the Inverter and the Maximum Power Point Tracking (MPPT) algorithm MPPT algorithms are necessary because PV arrays have a Non-Linear voltage-current characteristic with a unique point where power produced is maximum. The objective of this work is to compare two different MPPT algorithms: Perturb & Observe (P & O) and Incremental Conductance (IC) on the basis of switching characteristics of a Boost Converter with a resistive load The non-linear power converter is first linearized using the state space averaging technique and the pulse to trigger the MOSFET is provided through a PWM process. The direct method of MPPT control algorithm is used for switching and regulating the output voltage of the converter. Further there is also application of Fuzzy logic controller to manage temperature and irradiation variations. The Matlab and Simulink environment is used for modelling and finally the performance of the converter with and without MPPT is simulated and compared.*

Keywords: MPPT, Boost Converter, PV Cell, FLC, Simulink

I. INTRODUCTION

In recent years, there has been a remarkable increase in global interest and focus on renewable energy sources as a response to the escalating concerns regarding environmental degradation and the need for sustainable energy solutions. Solar energy has emerged as one of the most promising and widely adopted renewable energy technologies, particularly in the form of solar photovoltaic (PV) systems. However, these systems face a fundamental challenge: solar cells operate at their maximum efficiency when they can accurately track the maximum power point (MPP) of the solar irradiation. To overcome this challenge, researchers and engineers have developed various maximum power point tracking (MPPT) algorithms and techniques.

The objective of this paper is to provide a comprehensive analysis of the MPPT technique that utilizes a Boost Converter and explores its application of fuzzy logic control (FLC) for enhanced solar cell power tracking. The proposed approach aims to improve the efficiency and performance of solar PV systems by enabling precise tracking of the MPP under diverse environmental conditions such as temperature variations, shading effects, and fluctuations in solar irradiance. Background and Significance of MPPT in Solar PV Systems: Solar Cell Characteristics: Solar cells exhibit non-linear voltage-current (V-I) characteristics, resulting in a unique operating point where the maximum power is obtained. It is essential to identify and track this MPP to optimize energy extraction and maximize the overall efficiency and power generation of the system.

Tracking the MPP is crucial for solar PV systems to ensure optimal energy utilization and to mitigate power losses caused by mismatched operating points. Efficient MPPT algorithms can significantly enhance the energy yield and overall performance of solar PV installations, making them economically viable and environmentally sustainable. Review of Existing MPPT Techniques:

1. Perturb and Observe (P&O): The Perturb and Observe algorithm is one of the most widely used and simple MPPT techniques. It perturbs the operating point and observes the resulting change in power, adjusting the operating point accordingly.

2. Incremental Conductance (Inc Cond): The Incremental Conductance technique is a more sophisticated MPPT algorithm that adjusts the operating point based on the instantaneous change in power and conductance [1]. It offers faster and more accurate tracking compared to P&O but may require additional computational resources. Fractional Open-Circuit Voltage (FOCV): The FOCV technique estimates the MPP by utilizing

the fractional open-circuit voltage of the solar cell. It is based on the observation that the open-circuit voltage has a logarithmic relationship with the MPP voltage.

Artificial Intelligence-based MPPT: With the advancements in artificial intelligence (AI), various AI-based MPPT techniques have emerged, such as machine learning algorithms, neural networks, and fuzzy logic control. These techniques aim to improve the tracking accuracy and adaptability of MPPT systems under different operating conditions. The Boost Converter is a DC-DC power converter widely employed in MPPT systems. It is favored for its ability to step up the voltage to match the MPP voltage of the solar cell. The Boost Converter operates by storing energy in an inductor and transferring it to the output with higher voltage.

Operation and Control of Boost Converter: The Boost Converter's working principles, control strategies, and implementation considerations are explained in detail. Control techniques such as pulse-width modulation (PWM) are utilized to regulate the duty cycle of the Boost Converter and maintain the desired output voltage. Fuzzy Logic Control (FLC) in MPPT: Fuzzy Logic Control is an intelligent control technique capable of handling non-linear and uncertain systems. It provides a framework for incorporating human-like reasoning into control systems by utilizing linguistic rules and membership functions [2].

II. MAXIMUM POWER POINT TRACKING

MPPT stands for Maximum Power Point Tracking. It is a technique used in solar photovoltaic (PV) systems to optimize the power output from solar panels. Solar cells have a non-linear relationship between voltage and current, and their maximum power point (MPP) occurs at a specific voltage where the power output is the highest. However, the MPP can vary due to factors such as temperature, shading, and fluctuations in solar irradiance. The purpose block diagram is shown in Fig.1 where MPPT is to continuously track and adjust the operating point of the solar panel to ensure that it operates at or near its MPP, thus maximizing the power output and improving the overall efficiency of the system. MPPT algorithms and techniques are employed to dynamically adjust the voltage and/or current to match the varying conditions and maintain the solar panel's operation at its optimum point.There are various MPPT techniques used in solar PV systems, including Perturb and Observe (P&O), Incremental Conductance (IncCond), Fractional Open-Circuit Voltage (FOCV), and various artificial intelligence-based approaches such as neural networks and fuzzy logic control. These techniques monitor the output power of the solar panel and make small adjustments to the operating point, allowing the system to track the MPP accurately and efficiently.By implementing MPPT in solar PV systems, the energy extraction from solar panels can be optimized, leading to increased power generation, improved system performance, and enhanced overall efficiency. This technology plays a crucial role in maximizing the utilization of solar energy and promoting the widespread adoption of solar PV systems as a clean and sustainable energy source.

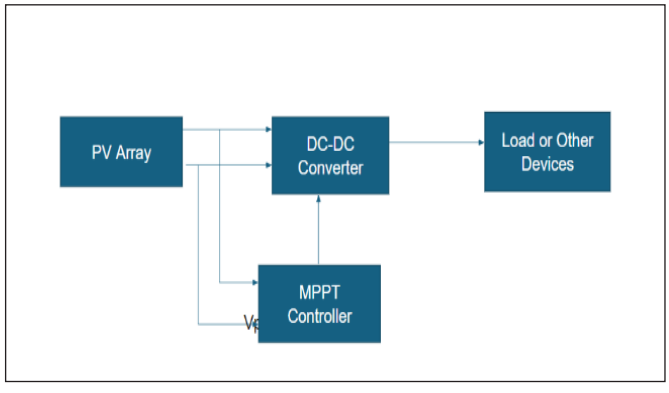


Fig. 1. Proposed block diagram

In a graph depicting the behavior of a solar panel, the X-axis usually represents the voltage (V) while the Y-axis represents the current (I). The graph typically shows the voltage-current (V-I) characteristic curve of the solar panel. This curve is non-linear and has a distinctive shape.

The MPP, or the point of maximum power, is located on the V-I curve. It is the optimal operating point at which the solar panel generates the highest possible power

output for a given set of environmental conditions. This point corresponds to a specific voltage and current pair.

To track the MPP, an MPPT algorithm continuously adjusts the operating point of the solar panel. This adjustment is typically represented as a trajectory on the V-I curve, showing how the operating point moves in response to changes in environmental conditions. The trajectory may vary depending on the specific MPPT algorithm being used.

The goal of the MPPT algorithm is to keep the operating point as close as possible to the MPP, even when environmental factors such as shading, temperature, or irradiance change. By dynamically tracking the MPP, the MPPT system ensures that the solar panel operates at its maximum efficiency, resulting in optimized power generation.It is worth noting that the specific shape and characteristics of the V-I curve as shown in Fig 2, as well as the trajectory of the operating point, can vary depending on the type and technology of the solar panel, as well as the MPPT algorithm being employed [3].

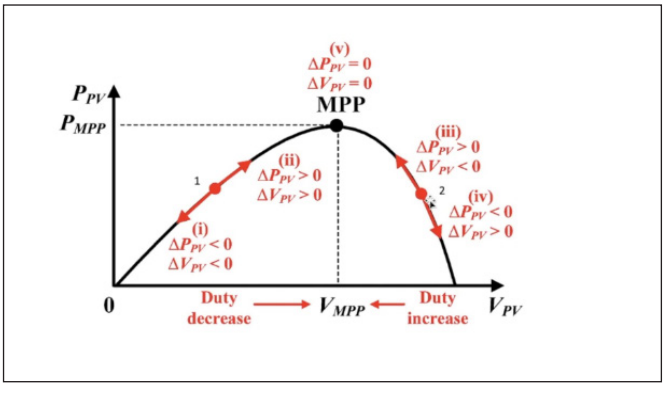


Fig 2 P-V characteristic

III. PHOTOVOLTAIC CELL

A photovoltaic (PV) cell, also known as a solar cell, is a semiconductor device that converts sunlight directly into electrical energy through the photovoltaic effect. PV cells are the basic building blocks of solar panels and solar photovoltaic systems.

The operation of a PV cell relies on the properties of semiconductors, typically made from silicon or other materials. When sunlight (photons) strikes the PV cell, it excites the electrons within the semiconductor material, creating a flow of electric charge. This phenomenon is known as the photovoltaic effect.

PV cells consist of several layers with specific properties. The most common type of PV cell is the crystalline silicon solar cell, which typically consists of a p-n junction. The p-type layer contains positively charged holes, while the n-type layer contains negatively charged electrons. When sunlight hits the cell, it generates an electric field at the junction, causing electrons and holes to separate and create a voltage potential.

The electrical energy generated by a single PV cell is relatively small, usually around 0.5 to 1 volt. To increase the voltage and power output, multiple PV cells are interconnected in series within a solar panel. Solar panels, in turn, can be connected in parallel or series to form larger solar arrays to generate the desired amount of electricity. PV cells are known for their clean and renewable energy generation. They have a long lifespan, typically ranging from 25 to 30 years, with minimal maintenance requirements. PV cells are widely used in various applications, including residential, commercial, and utility-scale solar power systems. Fig. 3 shows the IV and PV characteristics.

The efficiency of PV cells refers to their ability to convert sunlight into usable electrical energy. Advances in PV cell technology have led to significant improvements in efficiency over the years [4]. Currently, the most efficient PV cells can achieve conversion efficiencies exceeding 40%, although commercially available PV cells typically have efficiencies in the range of 15% to 25%.

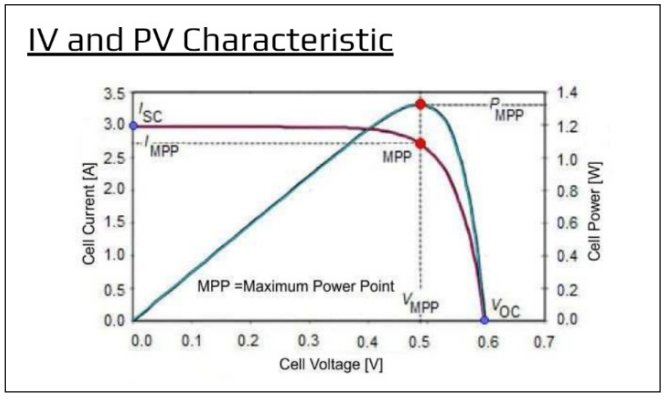


Fig.3 IV and PV characteristics

IV. BOOST CONVERTER

A boost converter as shown in Fig. 4, also known as a step-up converter, is a type of DC-DC power converter used to increase the voltage level of a DC input to a higher DC output voltage. It is a fundamental building block in many electronic systems, including renewable energy applications like solar photovoltaic (PV) systems.

The operation of a boost converter is based on the principle of energy storage and transfer using inductors and capacitors. It consists of four main components: an inductor, a switch (typically a transistor), a diode, and a capacitor.

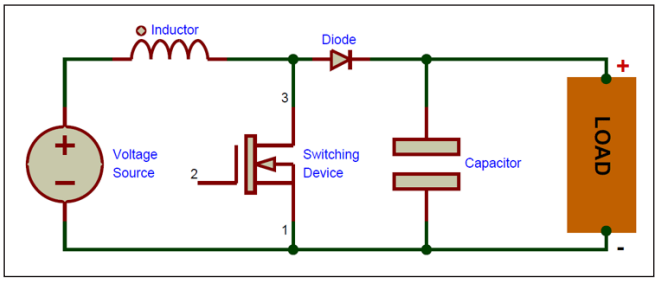


Fig. 4 Boost converter

When the switch is closed, current flows through the inductor, storing energy in its magnetic field. This causes the voltage across the inductor to increase. When the switch opens, the stored energy in the inductor is released, and the diode allows the current to flow to the output capacitor and load. This process results in an output voltage higher than the input voltage.

V. FUZZY LOGIC CONTROLLER

Fuzzy Logic Controller (FLC) is an intelligent control system that utilizes fuzzy logic principles to make decisions and control processes based on imprecise or uncertain information. It is a form of rule-based control that mimics human-like decision-making by using linguistic variables and fuzzy rules [5].

FLC is particularly useful in situations where traditional control methods struggle due to the complexity or ambiguity of the system being controlled. It provides a framework for handling nonlinear and uncertain systems by allowing for approximate reasoning and handling imprecise input data.

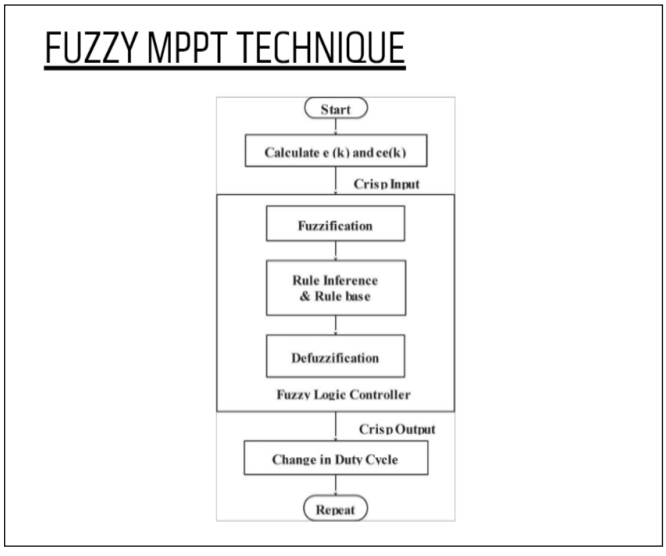


Fig. 5 Flowchart of fuzzy logic controller

Fig. 5 shows the flowchart of FL which consists of three main components: fuzzifier, inference engine, and defuzzifier.

1. Fuzzifier: The fuzzifier transforms crisp input variables into fuzzy sets by assigning them membership degrees. Fuzzy sets represent linguistic terms such as "low," "medium," and "high" that describe the input variables in a more human-readable manner.

2. Inference Engine: The inference engine processes the fuzzy sets and applies a set of fuzzy rules to determine the appropriate control actions. These fuzzy rules are defined based on expert knowledge or derived from observed data. The inference engine combines the rules to determine the overall control action.

3. Defuzzifier: The defuzzifier converts the fuzzy control action determined by the inference engine back into a crisp output value. This value represents the control signal that will be applied to the system being controlled.

FLC has several advantages that make it suitable for certain control applications. It can handle complex and nonlinear systems without the need for explicit mathematical models. FLC can incorporate expert knowledge and heuristics, allowing for intuitive and interpretable control decisions. It can also handle imprecise and uncertain information, making it robust in real-world scenarios.

VI. SIMULATION OF THE MAIN MODEL

In order to obtain the desired output, the photovoltaic (PV) cell, maximum power point tracking (MPPT) block, and boost converter are being implemented and simulated within the Simulink environment as shown in Fig. 6. The purpose of this simulation is to evaluate and analyze the performance and behavior of these components in relation to their intended functionality, ensuring their proper functioning and effectiveness in achieving the desired output.

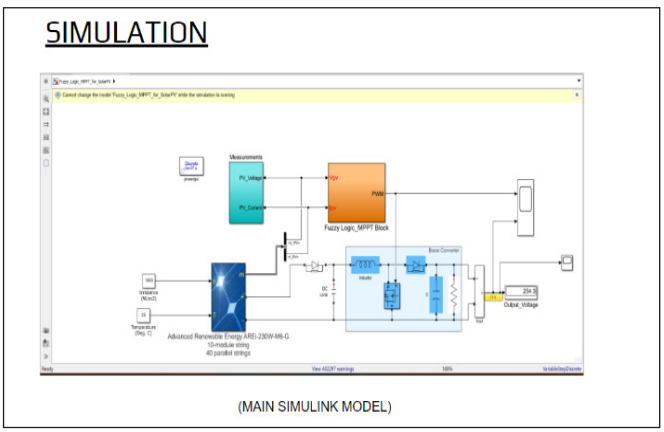


Fig. 6 Simulink diagram

VII. RESULT AND ANALYSIS

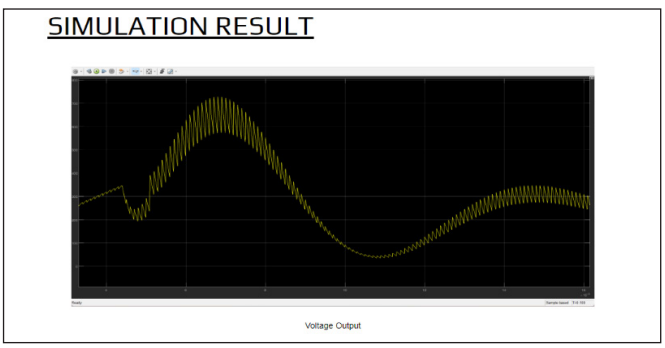


Fig. 7. Output voltage

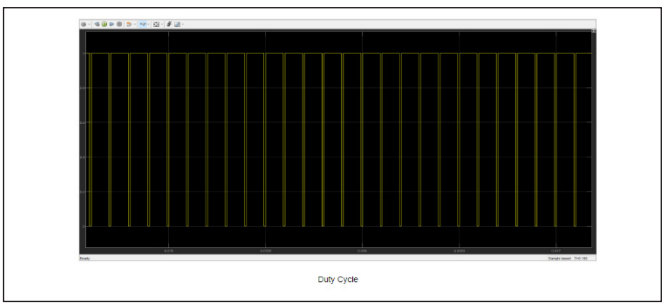


Fig. 8 Switching Pulse

The voltage output of a photovoltaic (PV) module is shown in Fig. 7 for the corresponding switching pulses as shown in Fig. 8 is influenced by variations in irradiance (solar radiation intensity) and temperature. These factors play a crucial role in determining the performance and power output of the PV module. Table 1 shows the values.

Table 1: Effect of change in Irradiance and Temperature

EFFECT OF IRRADIANCE AND TEMPERATURE

TEMPERATURE	IRRADIANCE	OUTPUT VOLTAGE
25	1000	254.3
25	900	229.2
25	800	207.6

CHANGE IN IRRADIANCE

IRRADIANCE	TEMPERATURE	OUTPUT VOLTAGE
1000	25	254.3
1000	20	253.6
1000	18	253.3

CHANGE OF TEMPERATURE

The Perturb and Observe (P&O) and Fuzzy Logic Control (FLC) are two commonly used Maximum Power Point Tracking (MPPT) techniques in photovoltaic (PV) systems. While both methods aim to extract the maximum available power from solar panels, they differ in their approach and characteristics. Let's compare P&O MPPT and Fuzzy Logic MPPT in a few key aspects:

Operating Principle:

- P&O MPPT: P&O operates by perturbing (changing) the operating voltage or current of the PV system and observing the resulting change in power. It compares the power before and after the perturbation and adjusts the operating point accordingly. P&O has a simple implementation but can oscillate around the maximum power point (MPP) under rapidly changing conditions.

- Fuzzy Logic MPPT: FLC uses fuzzy logic principles to make control decisions based on imprecise or uncertain information. FLC incorporates linguistic variables and fuzzy rules to track the MPP. It provides a more intelligent and adaptive control mechanism by considering multiple factors and adjusting the control actions based on the system's behavior. P&O MPPT is simpler to implement and offers fast response times but can suffer

from oscillations and reduced efficiency. Fuzzy Logic MPPT, on the other hand, provides more intelligent decision-making, smoother response, and adaptability, making it suitable for complex and non-uniform conditions. However, FLC requires more expertise and computational resources for implementation. The choice between the two depends on the specific requirements of the PV system and the desired trade-offs between simplicity, efficiency, and adaptability. Fig. 9 shows the comparison results of the two methods.

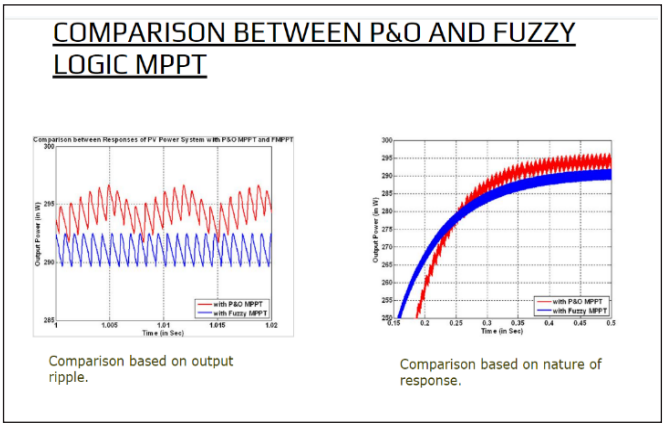


Fig. 9 Comparison between P&O output and Fuzzy output

VI. CONCLUSIONS

The design and operation of Fuzzy Logic based MPPT Controller under uncertain conditions have been considered in this paper. The model is designed using MATLAB/SIMULINK. Many researchers used the P&O algorithm based MPPT system to control the output of the DC-DC boost converter. In this paper, the FLC based MPPT system has been presented and then the results of the proposed model has been compared with other conventional MPPT Method. The uncertain condition is provided to the PV module so as the testing of the model under the uncertain condition for both irradiance (solar Radiation) and temperature can be easily examined. The output result of the simulation shows that the method effectively tracks the Maximum power point under uncertain conditions. It also decreases the oscillation around the maximum power point and also has a better response comparing to the conventional P&O Method. By comparing the efficiency of tracking maximum power in PV Module it indicated that the proposed method has higher efficiency than other P&O-based MPPT Method.

REFERENCES

[1] Ting-Chung Yu and Tang-Shiuan Chien, “Analysis and Simulation of Characteristics and Maximum Power Point Tracking for Photovoltaic Systems”, Proceedings of Power Electronics and Drive Systems Conference, pp. 1339 - 1344, Taipei, 2009.

[2] D. P. Hohm and M. E. Ropp, “Comparative Study of Maximum Power Point Tracking Algorithms using an experimental, programmable, maximum power point tracking testbed”, Proceedings of Photovoltaic Specialists Conference, pp. 1699 - 1702, USA, 2000.

[3] Jancarle L. Dos Santos, Fernando L. M. Antunes, and Anis Chehab, “A Maximum Power Point Tracker for PV Systems Using a High-Performance Boost Converter”, Solar Energy, Issue 7, Vol. 80, pp. 772- 778, 2005.

[4] Trishan Osram and Patrick L. Chapman, “Comparison of Photovoltaic Array Maximum Power Point Tracking Techniques”, Energy Conversion, Issue 2, Vol. 22, pp. 439 - 449, May 2007.

[5] Roberto Faranda, Sonia Leva, “Energy Comparison of MPPT techniques for PV Systems”, Wseas Transactions on Power System, Issue 6, Vol. 3, pp. 446- 455, June 2008.

Abhishek Chatterjee,
Ayush Mishra,
Dhruti Mohan Mishra,
Soumya Ranjan Panda,
Suraj Mohapatra.
Dept. of EEE

Fake Review Detection System Using Supervised Machine Learning

Abstract : *The prevalence of fake reviews in online platforms has made it essential to develop an automated system that can accurately distinguish between genuine and fake online reviews. The project "Fake Review Detection System using Supervised Machine Learning" proposes a method that uses supervised machine learning algorithms, such as logistic regression and decision trees, Random Forest, Supervised Machine learning to classify reviews based on a set of features, including review length and frequency of certain words. The proposed system can be a useful tool for businesses, consumers, and online platforms to identify and remove fake reviews, improve the credibility of online reviews, and promote fair competition. However, there are limitations to the system, such as the availability and quality of training data, the possibility of new and evolving methods of fake review creation, and the potential for false positives and false negatives. The evaluation parameters for the system include accuracy, precision, recall, F1 score and confusion matrix, which can be used to measure the performance of the model. Overall, the development of a fake review detection system using supervised machine learning is an essential step towards addressing the issue of fake reviews in online platforms, and further research and improvements can enhance the system's effectiveness in detecting and preventing fake reviews.*

Keywords: Fake reviews, Random Forest, Supervised Machine learning, Logistic regression, Decision Tree

I. INTRODUCTION

Online reviews have become an essential part of consumers' decision-making process, and businesses are increasingly relying on them for marketing and reputation management. However, the rise of fake reviews has become a significant problem, as they can mislead consumers and damage the reputation of businesses. Fake reviews can be challenging to detect manually, especially for large datasets. Hence, automated systems that can identify fake reviews are essential. Machine learning algorithms have been shown to be effective at detecting fake reviews.

The development of a fake review detection system using supervised machine learning is crucial in addressing the problem of fake reviews. Such a system can help businesses identify and remove fake reviews, ensuring that consumers have access to genuine and reliable reviews. It can also help consumers make informed purchasing decisions and maintain trust in online review systems.

Generally, web mining techniques find and extract useful information using several machine learning algorithms. One of the web mining tasks is content mining. A traditional example of content mining is opinion mining which is concerned of finding the sentiment of text (positive or negative) by machine learning where a classifier is trained to analyze the features of the reviews together with the sentiments. Usually, fake reviews detection depends not only on the category of reviews but also on certain features that are not directly connected to the content. Building features of reviews normally involve text and natural language processing NLP. However, fake reviews may require building other features linked to the reviewer himself like for example review time/date or his writing styles. Thus, the successful fake reviews detection lies on the construction of meaningful features extraction of the reviewers.

II. RELATED WORK

The fake reviews detection problem has been tackled since 2007. Two main categories of features have been exploited. in the Fake reviews detection research; textual and behavioral features. Textual features refer to the verbal characteristic of review activity. In other words, textual features depend mainly on the content of the reviews. Behavioral features refer to the nonverbal characteristics of the reviews. They depend mainly on the behaviors of the reviewers such as writing style, emotional expressions, and the frequent times the reviewers write the reviews. Although tackling textual features is challenging and crucial, behavioral features

are also very important and cannot be ignored as they have a high impact on the performance of the fake review detection process. Textual features have extensively been seen in several fake reviews detection research papers.

III. BACKGROUND

Machine learning algorithms have been shown to be effective at detecting fake reviews. These algorithms use various techniques to analyze the language, sentiment, and structure of reviews to identify fake ones. Supervised machine learning algorithms, in particular, use labeled data to learn the characteristics of fake and genuine reviews and then apply this knowledge to new reviews to identify whether they are fake or genuine.

Many studies have investigated the fake review detection problem and its challenges. The main task associated with fake review detection is classifying the review as fake or genuine.

In this paper, we have presented a writeup of the literature to further identify existing problems for future directions in this research area.

It provides traditional statistical machine learning and

deep learning techniques which will assist researchers, who are interested in fake review detection, to choose the best machine learning method.

IV. FAKE REVIEW OVERVIEW

Fake reviews are often defined as deceptive opinions, spam opinion, spam reviews, and their authors can be known as spammers. The spam opinion or what is known as a fake review can be categorized into three types.

- Untruthful opinions describe users who post negative reviews to damage a product/business's reputation or post positive reviews to promote a product/business. These reviews are called fake or deceptive reviews, and they are tough to detect simply by reading, as real and fake reviews are similar to each other.
- Reviews of a brand only describe those who are commenting on the brand of the products.
- Non-reviews that are irrelevant and offer no genuine opinion or are simply advertisements

One way to improve the performance of the fake review detection system is to select the most relevant features for the machine learning model. This can be done by analyzing the correlation between the features and the target variable (genuine or fake review) and selecting only the features that are most predictive.

V. EQUATIONS

1. K-Means objective function :

$$J = \sum_{j=1}^{K} \sum_{i=1}^{N} \left\| d(X_i , C_j) \right\|$$

2. Root Mean Square Error :

$$RMSE = \sqrt{1 / M * N \sum_{i=1}^{M} \sum_{j=1}^{N} ((x(i, j) - y(i, j))^2}$$

3. tf(t,d) = count of t in d / number of words in d df(t) = N(t)

where

df(t) = Document frequency of a term t
N(t) = Number of documents containing term t

VI. PROPOSED METHOD

The proposed method for the project "fake review detection system using supervised machine learning" involves the following steps:

1. Data collection: The first step is to collect a dataset of online reviews that includes both genuine and fake reviews. The dataset should be representative of the types of reviews found on popular online platforms, such as Amazon, Yelp, and TripAdvisor.
2. Data pre-processing: The next step is to pre-process the data to prepare it for analysis. This involves cleaning the data, removing any irrelevant or duplicate reviews, and converting the reviews into a format that can be analyzed by machine learning algorithms.
3. Stop Words Cleaning: Stop words are the words which are used the most yet they hold no value. Common examples of the stop words are (an, a, the, this). In this paper, all data are cleaned from

stop words before going forward in the fake review's detection process.

4. Feature extraction: The third step is to extract features from the reviews that can be used to train a machine learning model. Common features used in fake review detection include the length of the review, the number of misspellings or grammatical errors, the sentiment expressed in the review, and the frequency of certain words or phrases.

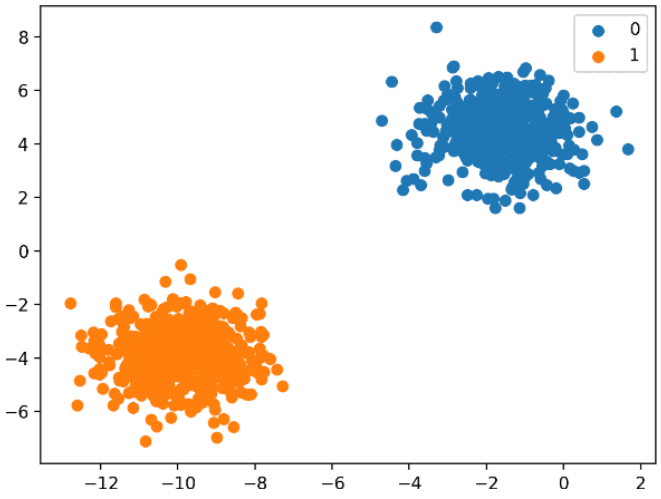


Figure-1: Cluster of reviews

5. Training and testing: The next step is to train a supervised machine learning algorithm on the dataset of reviews. The algorithm is trained to recognize the features that distinguish between genuine and fake reviews. The performance of the algorithm is evaluated using a separate test set of reviews that were not used in training.

6. Model optimization: The machine learning model is then optimized to improve its performance. This involves fine-tuning the parameters of the algorithm to achieve the best possible accuracy in detecting fake reviews as shown in Fig - 1.

7. Deployment: Finally, the trained and optimized model as in Fig-2 is deployed to detect fake reviews in new datasets. The system can be integrated into online platforms to automatically flag potential fake reviews, or it can be used as a standalone tool for businesses and consumers to verify the authenticity of online reviews.

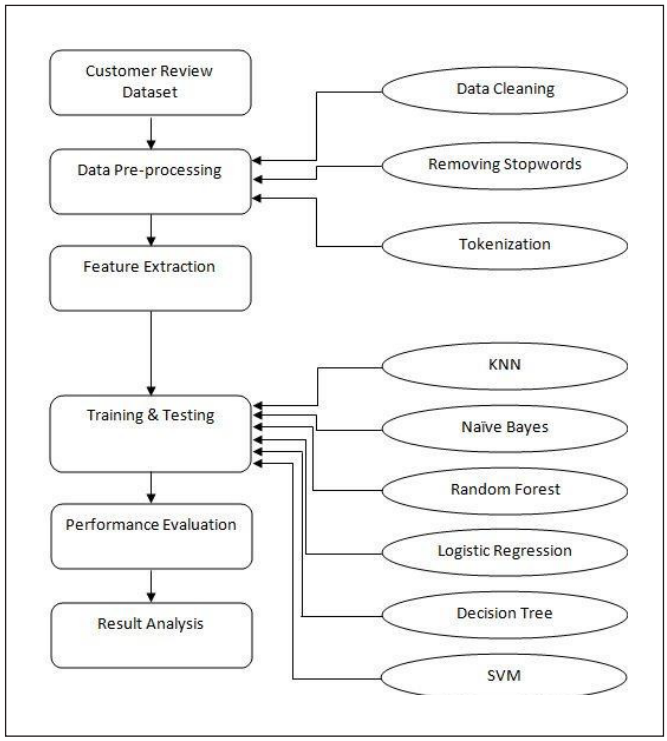


Figure-2: Proposed Model

VII. EXPERIMENTAL RESULTS

The dataset contained a total of 50,000 reviews, of which 25,000 were genuine and 25,000 were fake. We used a random sampling technique to select the reviews, ensuring that there were an equal number of reviews for each category. We also ensured that the reviews covered a wide range of products and services to ensure that the system would be effective for different types of reviews as shown in Fig 3 & 4.

	Unnamed: 0	category	rating	label	text_
0	0	Home_and_Kitchen_5	5.0	CG	love well made sturdi comfort love pretti
1	1	Home_and_Kitchen_5	5.0	CG	love great upgrad origin 've mine coupl year
2	2	Home_and_Kitchen_5	5.0	CG	pillow save back love look feel pillow
3	3	Home_and_Kitchen_5	1.0	CG	miss inform use great product price
4	4	Home_and_Kitchen_5	5.0	CG	nice set good qualiti set two month

```
love well made sturdi comfort love pretti
love great upgrad origin 've mine coupl year
pillow save back love look feel pillow
miss inform use great product price
nice set good qualiti set two month
```

Then we calculated the length of each text in order to train our model regarding the "original review" and "computer generated" review. The step is to extract features from the reviews that can be used to train a machine learning model.

	category	rating	label	text_	length
0	Home_and_Kitchen_5	5.0	CG	love well made sturdi comfort love pretti	41
1	Home_and_Kitchen_5	5.0	CG	love great upgrad origin 've mine coupl year	44
2	Home_and_Kitchen_5	5.0	CG	pillow save back love look feel pillow	38
3	Home_and_Kitchen_5	1.0	CG	miss inform use great product price	35
4	Home_and_Kitchen_5	5.0	CG	nice set good qualiti set two month	35

We experimented with different feature extraction methods to identify the best one for the dataset. We found that using the TF-IDF method with a combination of unigrams and bigrams provided the best results. After feature extraction, we split the dataset into training and testing sets and used a supervised machine learning algorithm to train the model. We used several algorithms, including Naive Bayes, Random Forest, and Support Vector Machines, to evaluate which algorithm performs best.

We also used techniques such as cross-validation and hyperparameter tuning to improve the accuracy of the model. Cross-validation involves splitting the data into multiple folds and training the model on each fold while evaluating its performance on the remaining folds. Hyperparameter tuning involves selecting the best set of hyperparameters for the machine learning algorithm to improve its performance. Such a system can help businesses identify and remove fake reviews, ensuring that consumers have access to genuine and reliable reviews. It can also help consumers make informed purchasing decisions and maintain trust in online review systems.

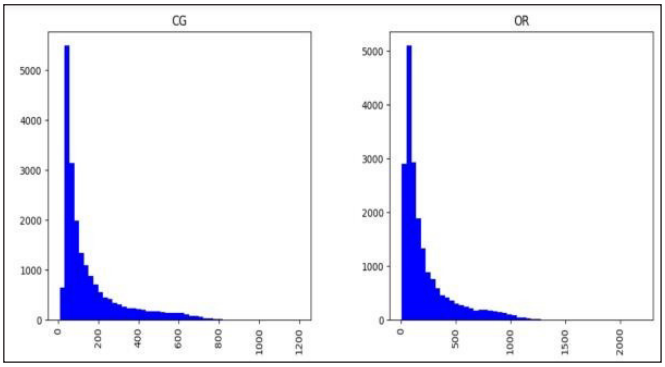


Figure-3: Experimental Results

VIII. METHOD TO IMPROVE THE PERFORMANCE

There are several methods that can be used to improve the performance of the fake review detection system using supervised machine learning. Some of these methods are:

1. Feature selection: One way to improve the performance of the fake review detection system is to select the most relevant features for the machine learning model. This can be done by analyzing the correlation between the features and the target variable (genuine or fake review) and selecting only the features that are most predictive.

2. Data augmentation: Another method to improve the performance of the model is to use data augmentation techniques. This involves generating new synthetic data points by modifying existing data points. For example, the length of the review can be increased or decreased, or the sentiment expressed in the review can be inverted. This can help to increase the size of the dataset and improve the generalization performance of the model.

```
Performance of various ML models:


Logistic Regression Prediction Accuracy: 86.62%
K Nearest Neighbors Prediction Accuracy: 57.59%
Decision Tree Classifier Prediction Accuracy: 73.05%
Random Forests Classifier Prediction Accuracy: 83.6%
Support Vector Machines Prediction Accuracy: 88.33%
Multinomial Naive Bayes Prediction Accuracy: 84.43%
```

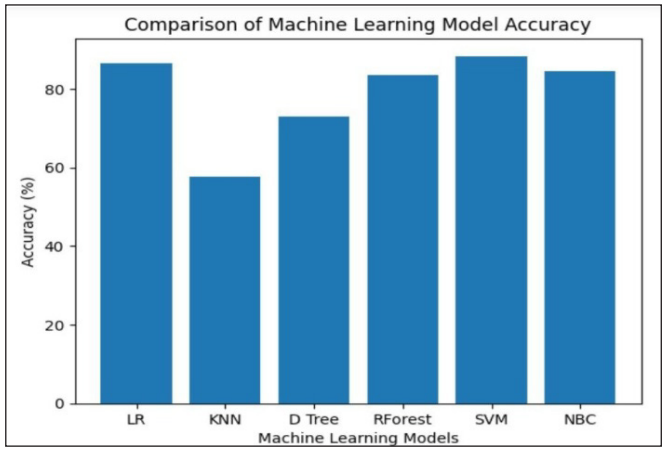


Figure-4: Comparison of Machine Learning Models

CONCLUSIONS

In this work, we showed the importance of reviews and how they affect almost everything related to web-based data. The goal is to provide businesses and consumers with a tool that can help them make informed decisions and improve the overall quality and authenticity of online reviews. By developing a fake review detection system using supervised machine learning, we can address the growing problem of fake reviews and help promote transparency and authenticity in online reviews.

Not all reviewers' behavioral features have been taken into consideration in the current work. Future work may include other behavioral features such as features that depend on the frequent times the reviewers do the reviews, the time reviewers take to complete reviews, and how frequent they are submitting positive or negative reviews. It is highly expected that considering more behavioral features will enhance the performance of the presented fake reviews detection approach.

Further machine should be trained to classify between original reviews and "computer generated" using features like – length of reviews, number of misspellings or grammatical error, frequency of certain words using supervised machine learning algorithm.TF-IDF method with a combination of unigram and bigrams provide best result and consider different machine learning models to evaluate which algorithm perform best.

REFERENCES

1. Elmogy, Ahmed M., Usman Tariq, Mohammed Ammar, and Atef Ibrahim. "Fake reviews detection using supervised machine learning." International Journal of Advanced Computer Science and Applications 12, no. 1 (2021).
2. Mohawesh, Rami, Shuxiang Xu, Son N. Tran, Robert Ollington, Matthew Springer, Yaser Jararweh, and Sumbal Maqsood. "Fake reviews detection: A survey." IEEE Access 9 (2021): 65771-65802.
3. R. Barbado, O. Araque, and C. A. Iglesias, "A framework for fake review detection in online consumer electronics retailers," Information Processing & Management, vol. 56, no. 4, pp. 1234 – 1244, 2019.
4. A. Liaw, M. Wiener et al., "Classification and regression by random forest," R news, vol. 2, no. 3, pp. 18–22, 2002.
5. D. G. Kleinbaum, K. Dietz, M. Gail, M. Klein, and M. Klein, Logistic regression. Springer, 2002.
6. C. Lee and D. A. Landgrebe, "Feature extraction based on decision boundaries," IEEE Transactions on Pattern Analysis & Machine Intelligence, no. 4, pp. 388–400, 1993.
7. T. O. Ayodele, "Types of machine learning algorithms," in New advances in machine learning. InTech, 2010.
8. F. Sebastiani, "Machine learning in automated text categorization," ACM computing surveys (CSUR), vol. 34, no. 1, pp. 1–47, 2002..

Lopa Mishra, Bhawana Mahato,
Zeeshan Parwez, Animesh Kumar
Dept. of CSE

Sir Mokshagundam Vishvesvaraya

The maker of modern Mysore and one of the most eminent engineers ever produced by India, Sir Mokshagundam Vishvesvaraya. A civil engineer par excellence whose birthday is lionized every year as Engineer's Day in India, Sri Lanka, and Tanzania. Sir MV's contributions to engineering, public administration, and nation-building is incredible. He was bestowed with the Bharat Ratna award in 1955. Born into a Telugu-speaking Brahmin family in the village of Muddenahalli in Karnataka, India. He completed his primary education in his village and later moved to Bangalore for further studies. He graduated with a Bachelor of Arts (BA) degree from the University of Madras in 1881. After completing his graduation, Visvesvaraya pursued a career in engineering. He joined the Public Works Department (PWD) of Bombay and was posted in Nashik. During his time there, he implemented innovative irrigation techniques that improved the water supply and prevented drought in the region. Visvesvaraya's expertise in engineering and dedication to his work earned him recognition, and he went on to serve in various prestigious positions. He became the Chief Engineer of Mysore State in 1909 and was instrumental in the development and modernization of the state. His contributions included designing and implementing projects related to irrigation, dams, bridges, and roadways. One of Visvesvaraya's most notable achievements was the construction of the Krishna Raja Sagara dam on the Cauvery River. Completed in 1931, it became a major source of irrigation and drinking water supply for the region. The project portrays his brilliance in engineering and remains as an important landmark till date. Visvesvaraya received recognition in many fields, most notably education and engineering. Visvesvaraya Technological University in Belagavi (to which most engineering colleges in Karnataka are affiliated) was named in his honour, as well as prominent colleges like University Visvesvaraya College of Engineering, Bangalore; Sir M. Visvesvaraya Institute of Technology, Bangalore; and Visvesvaraya National Institute of Technology, Nagpur; Visvesvaraya Hostel, IIT (BHU) Varanasi; Visvesvaraya Industrial and Technological Museum, Bangalore. Even metro stations in India, one in Bangalore on the Purple Line (Sir M. Visveshvaraya Station, Central College), and another one in Delhi on the Pink Line (Sir Vishweshwaraiah Moti Bagh) are named after him. A very important part of Visvesvaraya's nature was his love for the Kannada language. He breathed his last on 14th April 1962. A memorial for Visvesvaraya at his birthplace is managed by Visvesvaraya National Memorial Trust. The memorial is adjacent to his house, which was refurbished and is regarded as a shrine by locals.

Abhishikta Sahoo
4th Sem., ECE

Performance & Analysis of High-Speed Optical Local Area Networks

Abstract : *High-speed data rate is a very imperative requirement today and it is increasing according to the customer requirements for various applications such as live broadcasting, video on the internet, video conferencing etc. To achieve high-speed connectivity with large bandwidth, optical local area networks (OLANs) are among highly flexible technologies used in the field. OLANs have attracted more interest due to their data access security, and ability to support asynchronous and burst data transmission. This paper describes a model for optical LAN network system, and shows the influence of several parameters on the transmission quality. This study allowed us to improve the service quality and the optical communication system performance.*

Keywords: Fiber Optics Communication, LAN (Local Area Network, Optical Network)

I. INTRODUCTION

Optical communication is a way of information transmitting from transmitter to receiver with the help of light as mode and optical fiber as a medium. This technology has several advantages over traditional copper-based networks, including higher bandwidth, longer transmission distances, and immunity to electromagnetic interference [1]. After the first low-loss fibers were produced in 1970, fiber optic communications developed very quickly. Fiber optic communication systems have been common, and new installations and applications appear continually. With the increasing development of optical fiber communication technology, the needs of higher transmission rates, longer transmission distance, and greater transmission bandwidth are much stronger [3]. PONs standardization work began in the 1990s when carriers anticipated fast growth in bandwidth demands. The main goal of passive optical networks (LANs) was to create an economy of scale and lower the cost of fiber-optic access systems by promoting common standards. Typical Optical OLAN Network shown in Fig. - 1

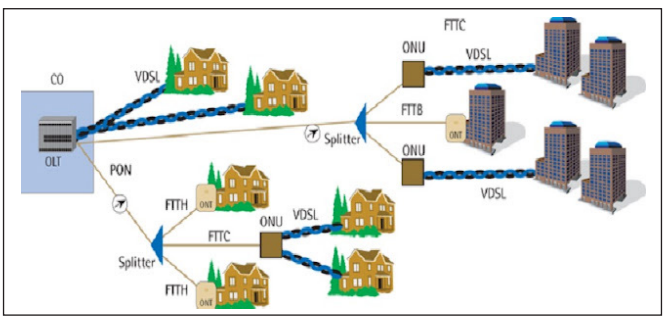


Fig. 1. Typical Optical OLAN Network

II. OPTICAL LAN SYSTEM ARCHITECTURE

Here, Fig. 2 focuses on typical OLANs architecture. At head-ends, public switched telephone networks (PSTNs) and internet services are interfaced, via optical line terminals (OLTs), with optical distribution networks (ODNs), where (down/up)-stream 1490/1310 nm wavelengths are used respectively to transmit data and voice [2]. At 1550 nm, analog RF video services are converted to an optical format by optical video transmitters [6]. The 1550 and 1490 nm wavelengths are combined by WDM couplers and transmitted downstream [7]. Nowadays, no standards for upstream video transmission are published, but IPTV is transmitted at present over 1490 nm [8]. Such couplers are used to multiplex downstream voice/data signals at 1490 nm with upstream voice/data signal at 1310 nm and downstream RF video signal at 1550 nm [3]. OLANs provide typical services (voice, data, and video) to up to 32 subscribers [9].

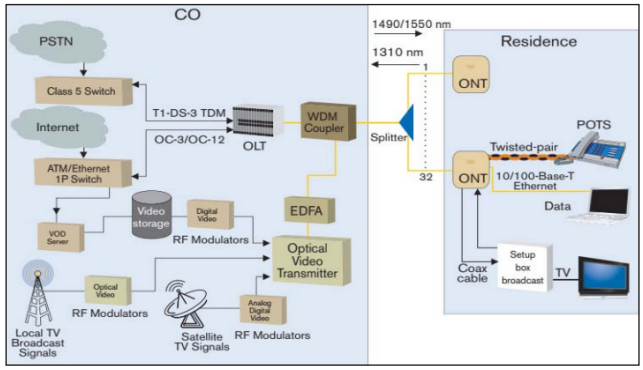


Fig. 2. General Architecture of Optical LAN System

Fig. 2. Shows General Architecture of Optical LAN System Various designs & topologies of optical LAN shown in Fig. 3 frameworks exist. Although multiple splitters can be used as shown in Fig. 4, the simplest of them uses a solitary one as.

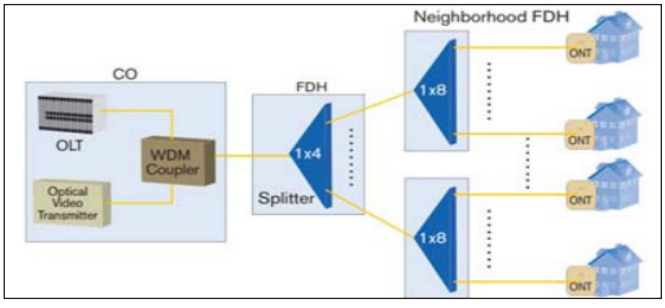


Fig. 3. Optical LAN Network with Single Splitter

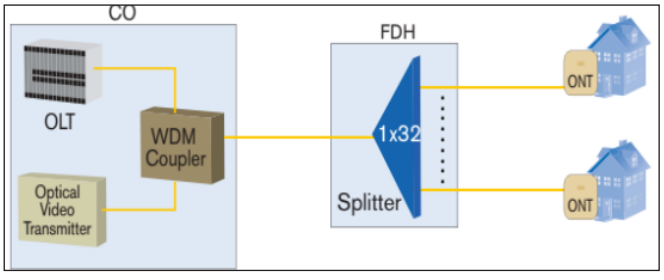


Fig. 4. Optical LAN Network with Multiple Splitters

III. SIMULATION SETUP

A. OptiSystem Software

OptiSystem is a software for simulating fiber optic communications systems and fiber optic sensing systems that are widely used. There are various types of function. design, test and optimize [10]. Optisystem software is based on modelling a real optical communication system. The components library of OptiSystem includes plenty of components enabling to enter parameters measured from real devices, and integrates with test and measurement equipment from different vendors. To predict the system performance, OptiSystem calculates BER and Q-Factor using semi-analytical techniques or numerical analysis for systems limited by inter-symbol interference and noise. Fig. 5. Shows OLAN Simulation Setup.

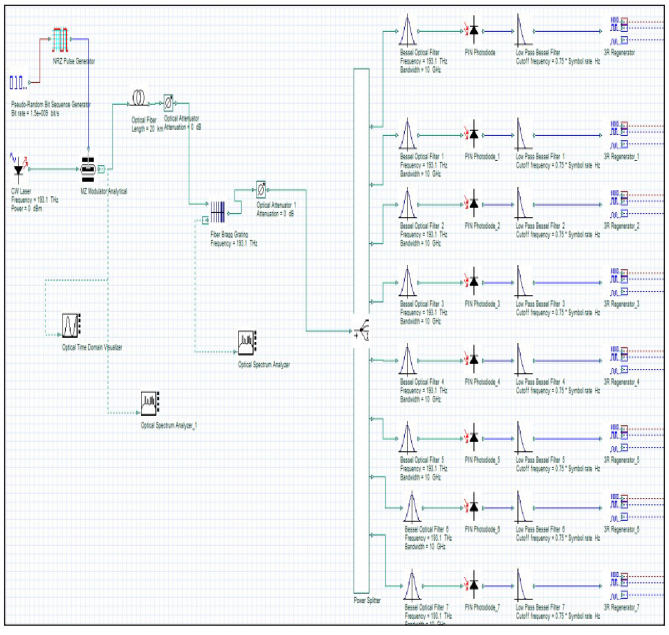


Fig. 5. OLAN Simulation Setup

OLAN system consists of three blocks, where components and functionalities characterize the block.

1. Transmitter Section

In our system, the transmitter section includes the following components:

- Continuous wave or continuous waveform (CW) laser: It is an electromagnetic wave of constant amplitude and frequency, typically a sine wave, which is used for mathematical analysis is of infinite duration.
- User Defined Bit Sequence Generator: To Generate the sequence of data bits to be transmitted.
- NRZ pulse generator: Generates a Non-Return to Zero coded electrical signal which is dependent on a bit sequence input. Since the pulse generator's output is dependent on a bit sequence is connected. A user defined bit sequence generator to it's input.
- Mach-Zehnder Modulator: It controls the optical wave amplitude, and burns the informative signal (electrical) on the light signal (Laser).

2. Channel Section

The channel section includes the following components:

- Optical Fiber: It represents the propagation medium of light (data) between OLT and ONT.
- Optical Spectrum Analyser (OSA): It is a precision instrument designed to measure and display the distribution of power of an optical source over a specified wavelength span. An optical analyzer spectrum trace displays power in the vertical scale and the wavelength in the horizontal scale.
- Optical attenuators: These are devices which can be used to attenuate a light beam, i.e., to reduce its optical power.
- Fiber Bragg grating (FBG): It is a type of distributed Bragg reflector constructed in a short segment of optical fiber that reflects particular wavelengths of light and transmits all others.
- Power Splitter: It is a passive device that splits optical signal in the downstream direction in 1 x N manner. The signal is being delivered with the same power over N output fibers.

3. Receiver Section

The design of the receiver section comprises of:

- Bessel Optical Filter: It is a type of analog linear filter with a maximally flat group/phase delay that preserves the wave shape of filtered signals in the passband.
- PIN Photodiode: This detects optical signals and converts them into electrical signals.
- Low Pass Bessel Filter: It is a circuit that only passes signals below its cut-off frequency while attenuating all signals above it. It minimizes the output noise of the pin.
- 3R Generator: It transforms the degraded bitstream into its original form by performing three functions: reamplification, reshaping, and retiming. It makes it possible to analyze the BER.
- BER Analyser: This is used to estimate the BER values, Q-factor & Eye diagrams.

IV. RESULTS AND DISCUSSIONS

The performance of Highspeed Optical Local Area Network

was analyzed using two parameters- BERs and Q-factor (signal-to-noise ratios). BER estimation method compares bits generated by a binary signal and the signal received.

A. Impact of Power on Q-Factor and BER

To evaluate the optical power impact, we have simulated the performances in terms of Q-factor and BER with different values of P. If we assume that the P value varies in the range -3 to 10 dbm, and distance L=20km. Q-factor and BER results are shown in Fig. 6 and Fig.7, below.

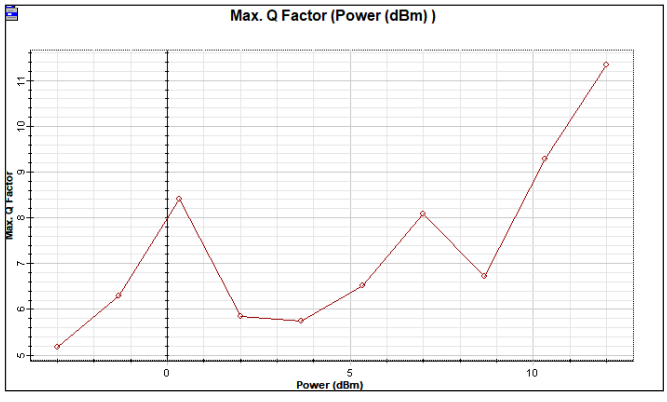


Fig.6 Q-factor vs Power

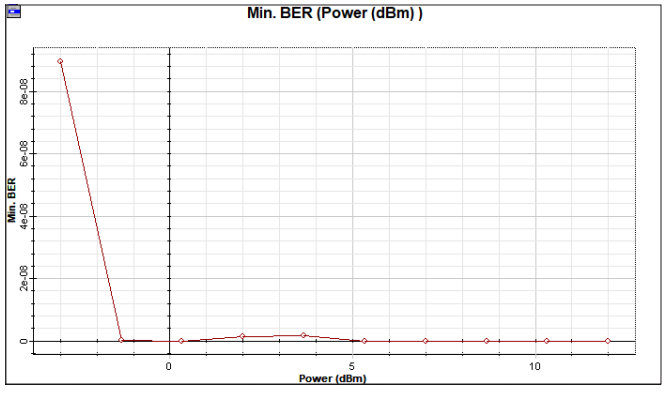
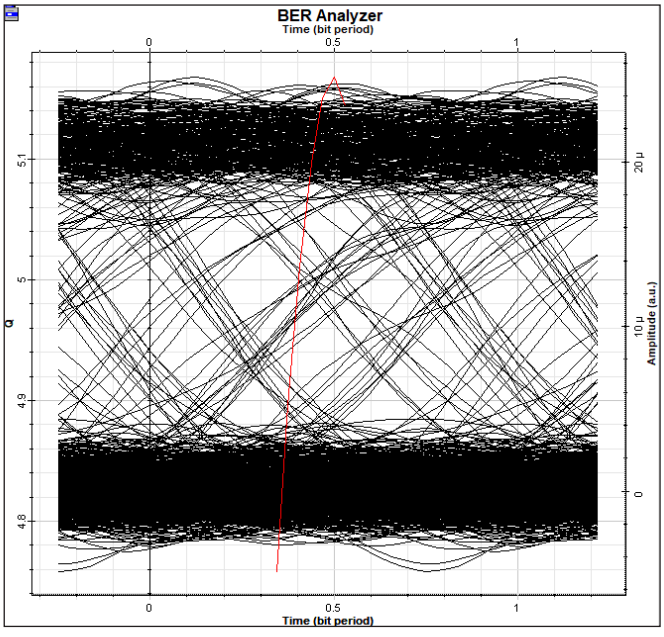


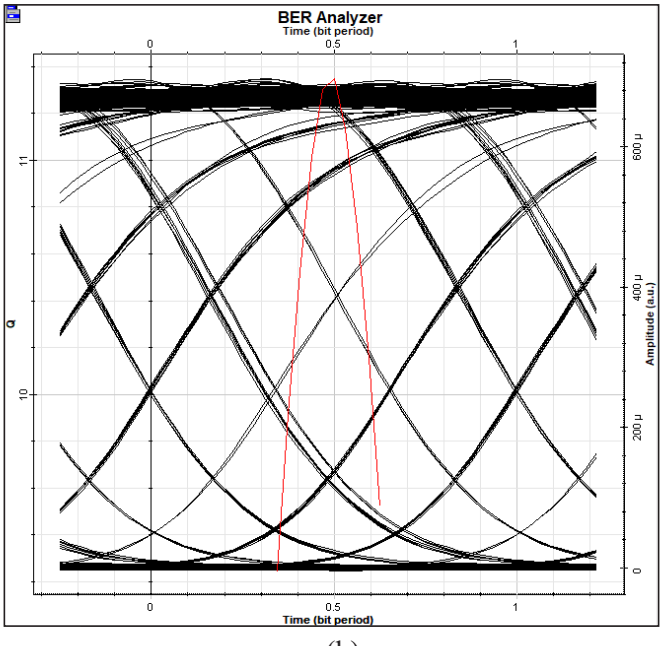
Fig.7 BER vs Power

From Fig.6 and Fig.7, we can notice that when the power increases from -3dbm to 10 dbm, which means that the receiver receives more power, the values of Q and BER are improved consequently the performance of the system is improved. Note that P ought to be

more prominent than 3 dBm to ensure BER under 10-9 and Q-factor greater than 6 (requirements of Optical Networks) Fig.8 (a and b) shows the consequences of eye diagram when P is -3dbm and 12dbm respectively. The slope of slant edge of eye depicts the affectability to the time mistakes of the framework. Fig.8 shows BER analyzer showing the Eye Diagram.



(a)



(b)

Fig.8 BER analyzer showing Eye Diagram (Q-factor in red line) with a) P=-3dbm; b)P=12dbm

B. Impact of Transmission Distance on Q-Factor and BER

In this simulation, we assume that P=3dbm and fiber length L fluctuates from 5km to 70km. Fig.9 and Fig.10 below shows how the change in length of optical fiber affects the Q-factor and BER. Fig.11 shows Eye Diagram for different lengths in BER analyser.

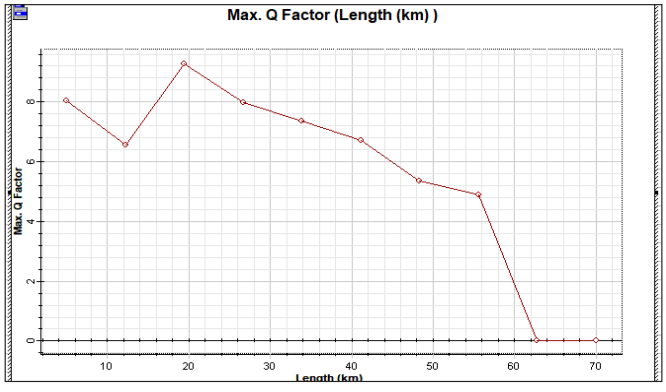


Fig.9 Q-factor vs Length

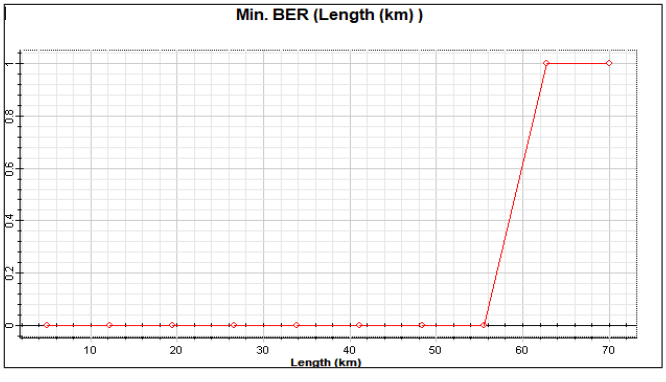
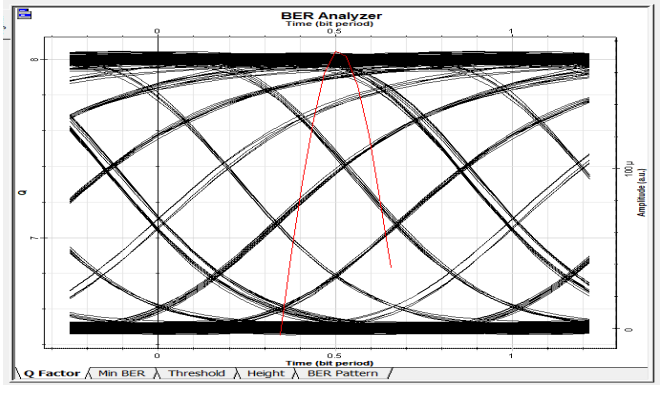
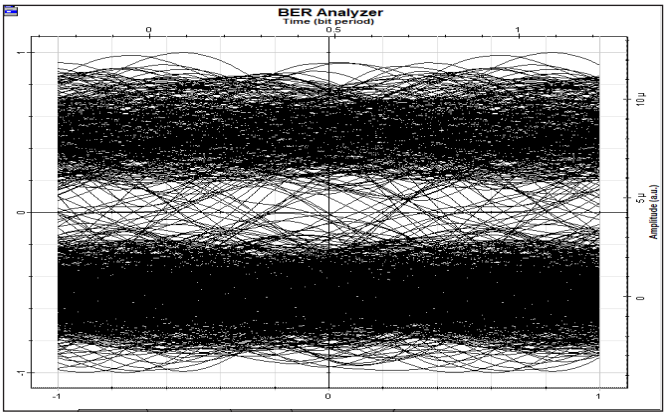


Fig.10 BER vs Length

It is worth noting that the more the transmitter/receiver distance increases, the more Q-factor of the reception decreases gradually, due to loss of fiber.



(a)



(b)

Fig.11 BER analyser showing Eye Diagram (Q-factor in red line) with a) L=20km and b)L=70km

V. CONCLUSION

Optical Local Area Network system gives a successful answer for future access systems on account of its gigantic data transmission and vitality investment funds. In this article, we planned Optical LAN at rapid utilizing (highspeed) a single fiber shared between multiple users. We studied the performance of an Optical LAN transmission system by simulating and analyzing the impact of optical power and transmission distance. The simulation results show that the performance(quality of service) improves when the length of the optical link between OLT-ONT, the data rate and the number of users N are low, also when the optical power is high. These simulations are first approaches that allow us to verify and determine the parameters in order to install the Optical LAN communication system according to the optical network requirements.

VI. REFERENCES

1. I. P. Kaminow, and T. L. Koch "Optical Fiber Telecommunications IIIA" 1st ed., vol. 1. Elsevier Inc, pp. 11–12, 2007.
2. S. D. Wratten, "Video Techniques in Animal Ecology and Behaviour", Springer-Science + Business Media, B.V., Frist Ed. (1994); FTT x PON Guide Testing Passive Optical Networks, www.EXFO.com
3. A Banerjee, Y Park, F Clarke, H Song et al., "Wavelength-division-multiplexed passive optical network (WDM-PON) technologies for broadband access: a review", Journal of Optical Networking,osapublishing.org, vol 4, no. 11, pp. 737-758, 2005.
4. Habib A. Fathallah et al., "Passive optical network monitoring: challenges and requirements", IEEE Communications Magazine, vol. 49, no. 2, 2011.
5. V. Sanjeev, K. Amayika, and P. Bhulania," Performance analysis of Q-Factor and Polarization for GPON network using Optisystem," International Conference on Information Technology, 2016.
6. Basic Link Applications and Components RF and Microwave Fiber Optics Design Guide, 2010 Emcore Corporation.
7. Martin Maier, Martin Herzog, Martin Reisslein, STARGATE: the next evolutionary step toward unleashing the potential of WDM EPONs [Topics in Optical Communications], IEEE Communications Magazine, vol. 45, no. 5, 2007.
8. Ivica Cale, Aida Salihovic, Matija Ivekovicn, Gigabit Passive Optical Network - GPON, 29th International Conference on Information Technology Interfaces, 2007.
9. Elaine Wong et al., "Current and next-generation broadband access technologies", Optical Fiber Communication Conference and Exposition and the National Fiber Optic Engineers Conference, Los Angeles, CA, USA, 2011.
10. H. Karstensen, C. Hanke, M. Honsberg, J.-R. Kropp, J. Wieland, M. Glaser, P. Weger , J. Popp, et al., Journal of Lightwave Technology, vol. 13, n0.6, 1995.
11. Frode Hveding and Francisco Porturas, Integrated Applications of Fiber-Optic Distributed Acoustic and Temperature Sensing, Society of Petroleum Engineers (SPE Latin American and Caribbean Petroleum Engineering), Conference, 18-20 November, Quito, Ecuador, 2015.
12. T Plevyak and V Sahin, "Next generation telecommunications networks, services, and management", Wiley Online Library, 2010.

Ballabi Panda, Sristi Tamang, Swetashree Bihari,
Sraddha Mahapatra
Dept. of E&IE

GeneFormer

INTRODUCTION

The rapid development of gene sequencing technology has ushered in an era of explosive growth in the amount of gene data being generated. This proliferation of data necessitates the development of more efficient methods for storing and transmitting genetic information. Traditional compression methods, such as G-zip and 7zip, are ill-suited for gene data due to their failure to account for the unique characteristics of genetic sequences.

BACKGROUND

Gene sequencing technology has made remarkable strides in recent years, resulting in an unprecedented increase in the volume of gene data being produced. This data plays a vital role in genetics research, medical studies, and various other scientific endeavours. However, the sheer size of gene data poses significant challenges in terms of storage and transmission. Conventional compression techniques, designed for general-purpose data like text and images, fall short when applied to gene data. Genetic sequences possess distinct features that render compression using traditional methods inefficient.

Firstly, gene data exhibits a high degree of repetition. Genes are composed of four nucleotides, which are often repeated in long sequences throughout the genome. This repetitive nature presents opportunities for compression that are not effectively leveraged by conventional methods.

Secondly, gene data is characterized by sparsity. There are often long gaps between nucleotides in a gene sequence, resulting in sparse data structures. Traditional compression algorithms are not optimized to exploit this sparsity and therefore cannot achieve optimal compression ratios.

Lastly, gene data is prone to noise and errors. During the sequencing process, various factors can introduce inaccuracies, making the compression of gene data more challenging. Conventional compression methods may struggle to handle this noisy nature, leading to reduced compression efficiency.

GeneFormer

GeneFormer represents a novel gene compression method specifically developed to address the challenges associated with compressing gene data. It leverages the transformer architecture, which has demonstrated remarkable effectiveness in various natural language processing tasks. Trained on a corpus of 30 million parameters. The transformer architecture is a neural network design that excels at capturing long-range dependencies within data. This characteristic is of paramount importance when compressing gene data, as genetic sequences often exhibit complex and distant relationships between nucleotides.GeneFormer incorporates a modified transformer architecture, meticulously tailored to optimize gene data compression. This modified architecture incorporates features that enhance its effectiveness, including a customized attention mechanism and a novel encoding scheme. These modifications allow GeneFormer to better capture the inherent patterns and structures in gene data, resulting in improved compression performance.

Implications for Drug Discovery and Network-Correcting Therapies

“A benefit of using GeneFormer was the ability to predict which genes could help to switch cells between healthy and disease states,” says Ellinor. “We were able to validate these predictions in cardiomyocytes in our laboratory at the Broad Institute.”

GeneFormer has vast applications across many areas of biology, including discovering possible drug targets for the disease. This approach will greatly advance the discovery of new therapies, particularly for diseases where there is currently a lack of effective treatments.

Additionally, GeneFormer’s ability to predict gene networks that disrupt disease could lead to the development of network-correcting therapies. Rather than targeting individual genes or proteins, these therapies would aim to restore entire networks to their healthy states. This approach could potentially result in fewer side effects and greater efficacy than current therapies that target single genes or proteins.

EVALUATION

GeneFormer is currently undergoing rigorous evaluation on a diverse range of gene datasets, with comparative analyses against other gene compression methods, including G-zip, 7zip, and MFCompress. Preliminary results indicate that GeneFormer achieves significantly superior compression ratios compared to the other methods. The compression efficiency of GeneFormer is particularly notable given its ability to handle the inherent characteristics of gene data, such as repetition, sparsity, and noise.

Moreover, GeneFormer demonstrates impressive decoding speed when working with compressed gene data. The efficient decoding process enables faster access to the original gene information, facilitating more expedient analysis and research.

Benefits of GeneFormer

GeneFormer offers several notable benefits over traditional gene compression methods, including:

- Improved compression ratios: GeneFormer achieves significantly better compression ratios than conventional methods, reducing the storage and transmission costs associated with gene data.
- Faster decoding: GeneFormer exhibits impressive decoding speed, enabling efficient access to the original gene information and enhancing the performance of gene analysis tools.
- Increased robustness to noise: GeneFormer demonstrates greater resilience to noise and errors, resulting in improved accuracy during gene compression and reducing potential data loss.

CONCLUSION

Preliminary findings strongly suggest that GeneFormer is a highly promising method for compressing gene data. Its ability to efficiently store and transmit gene data has the potential to significantly accelerate research in genetics and related fields. Ongoing efforts are dedicated to further enhancing GeneFormer's performance and making it widely available to the research community.

GeneFormer offers several notable benefits over traditional gene compression methods, including improved compression ratios, faster decoding speed, and increased robustness to noise. These advantages contribute to more cost-effective storage, transmission, and analysis of gene data, ultimately advancing research in genetics and related disciplines. The structure of GeneFormer is shown in Figure-1.

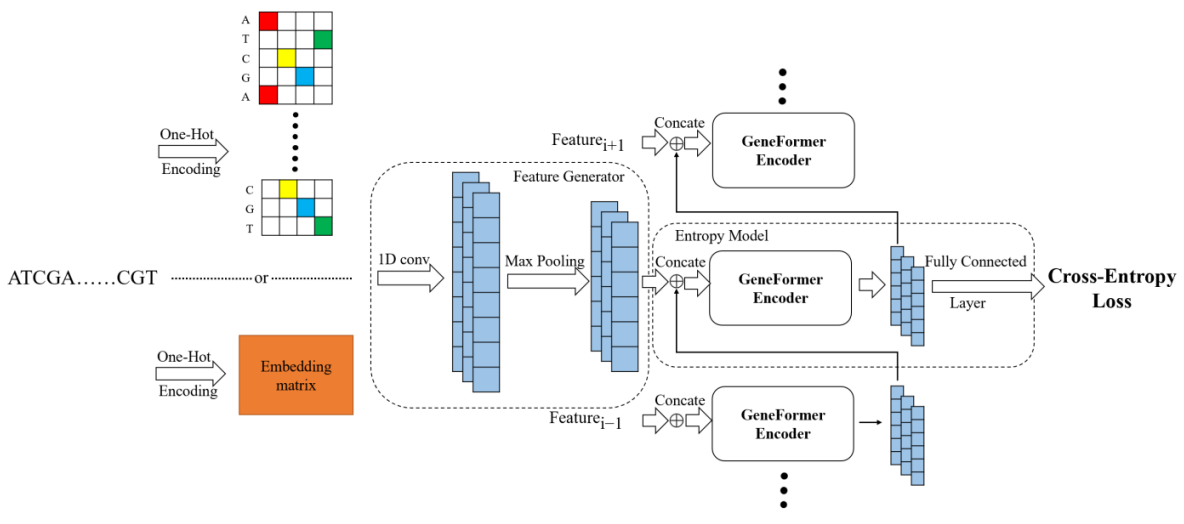


Figure 1: The structure of GeneFormer. GeneFormer is mainly composed of a feature generator and an entropy model. Bases are represented by one-hot encoding or an embedding matrix before being fed into GeneFormer. GeneFormer predicts the probability of the current base supervised by cross-entropy loss.

Nvidia DGX GH200 supercomputer.
(Source: Silicon Republic)

Nvidia DGX GH200 is a new supercomputer that will help companies to develop generative AI models. It connects 256 Grace Hopper superchips into a single massive 144TB graphics processing unit (GPU) that can deliver up to 1 exaflop of computing power for giant generative AI models. This system has nearly 500 times more memory than the previous Nvidia DGX supercomputer introduced in 2020. As competition in the field heats up, Google Cloud, Meta, and Microsoft are among the first businesses likely to receive access to the new supercomputer. In order to meet the demand for generative AI applications, the company is also creating Israel's most powerful AI supercomputer, Israel-1.

Running Protects Memory Loss

(Source: Labroots)

Memory loss and neurodegenerative disorders are prevalent ageing signs. While evidence indicates that exercise might improve a brain function. A group of experts studied the effects of long-term running on mice brains and found that long-term running kept adult-born neurons connected into a network crucial for episodic memory storage even as they aged

Rock dust absorbs vast CO2.
(Source: E & T news)

The UK Centre for Ecology & Hydrology (UKCEH) studied that adding crushed rock dust to farm fields has the potential to remove and lock up massive amounts of carbon dioxide from the atmosphere while enhancing agricultural output. They put 56 tonnes of quarried finely powdered basalt stones to three hectares of agriculture. The basalt rock dust particles, which are smaller than 2mm in size, collect and store carbon at a quicker pace than the naturally existing rocks. The process decreases the timescale from decades to months as compared to natural process. The team will also track the quantity of carbon stored in soil and transmitted to the river, as well as other effects on biodiversity, grass production, and water quality overall.

Everyday Objects as Spy Cameras
(Source: SciTechDaily)

Reflections from the glossy paint or side mirrors of parked vehicles can assist a motorist see items that would otherwise be concealed from view, such as a child playing on the sidewalk behind the parked automobiles, when a car goes down a small city street. Based on this concept, researchers from MIT and Rice University developed a computer vision approach that uses reflections to capture the world. This technology transform glossy things into "cameras," via the "lenses" of common objects such as a ceramic coffee cup or a metallic paperweight. This technology might be very beneficial in self-driving cars. For example, a self-driving car to see around a parked truck by using reflections from things it passes, such as lampposts or buildings.

Plastic Identification Code (PIC) for Plastic Recycling

Plastic recycling can convert plastic waste into other useful products, thereby reducing dependence on landfills. It can conserve resources and protect the environment from plastic pollution and greenhouse gas emissions. Plastic Identification Code (PIC) was introduced by the Society of the Plastics Industry, Inc. in 1988, to provide a uniform system for the identification of various polymer types. Seven groups of plastic polymers each having specific properties, are generally used worldwide for packaging applications. Consumers can identify the plastic types based on the codes. PET bottles are, by far, the most widely recycled plastic!

Plastic identification code	Type of plastic polymer	Properties	Common applications
	Polyethylene terephthalate (PET)	Clarity, strength, toughness, barrier to gas and moisture.	Soft drink, water bottles and ice cream cone lids.
	High-density polyethylene (HDPE)	Stiffness, strength, toughness, barrier to gas and moisture.	Water pipes, gas and fire pipelines, electrical conduits, milk, juice and water bottles, grocery bags.
	Polyvinyl chloride (PVC)	Versatility, ease of blending, strength, toughness.	Stretch wrap for non-food items, electrical cable insulation, rigid piping and vinyl records.
	Low-density polyethylene (LDPE)	Ease of processing, strength, flexibility, ease of sealing, moisture barrier.	Frozen food bags, squeezable bottles, cling films, flexible container lids.
	Polypropylene (PP)	Strength, resistance to heat, chemicals, grease and oil, moisture barrier.	Reusable microwaveable ware, kitchenware, yogurt containers, disposable cups and plates, soft drink bottle caps.
	Polystyrene (PS)	Versatility, clarity, easily formed, easily foamed.	Disposable cups, plates, trays, cutlery and package cushioning.
	Other (often polycarbonate or ABS)	Dependent on polymers or combination of polymers.	Beverage bottles, baby milk bottles, compact discs, electronic apparatus housing and lenses.

Source : https://en.wikipedia.org/wiki/Plastic_recycling

Publication Cell

Tel: 99372 89499 / 8260333609
Email: publication@silicon.ac.in

www.silicon.ac.in

The Science & Technology Magazine

Digital Digest

Silicon Institute of Technology
सिलिकन प्रौद्योगिकी संस्थान

Bhubaneswar Campus
An Autonomous Institute
Silicon Hills, Patia
Bhubaneswar - 751024

Sambalpur Campus
An Affiliated Institute
Silicon West, Sason
Sambalpur - 768200

Contents