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Human Emotional Quotient Grading System using Neural Responsive Pattern for Diagnosing Metabolism Disorders

Thivaharan.S
Dept. of CSE, PSG Institute of Technology and Applied Research, Coimbatore

Abstract: ***We propose a human emotional quotient grading system [HEQGS] to predict the proximity of a person, developing into the metabolism disorders and also to diagnose the irregularity or the control a patient possess over the disorder. Metabolism disorders exist in human in various forms, the most common being diabetes mellitus and thyroids. Human emotional quotient [HEQ] is the factor signifying a person's withholding capability to keep settled or balanced under depressive conditions. HEQ contribute as well as plays a part in these metabolism disorders. We in this paper prepared a model for grading the HEQ using a neural responsive pattern [NRP], where NRP is the pictorial representation of brain signals. Developing such system helps in monitoring the medication a person undergoes. We developed the model based on the identified and new "Pressure Cooker Effect".***

Keywords: Human Emotional Quotient, Metabolism disorders, Diabetes Mellitus, Depressive Conditions, Neural Responsive Pattern [NRP], Brain Signals.

I. INTRODUCTION TO HEQGS

A. Model of HEQGS

The Human Emotional Quotient Grading System [HEQGS] takes Investigative factors as input and generates the percentage of proximity that the subject getting caught into metabolism disorders. Normally Investigative factors are broadly classified into physical factors and bounding factors. Physical factors include but not limited to "Body – Mass – Index [BMI]", Hormone Reflexive Status [HRS], Existing Pre-Medical conditions, Neural Responsive Pattern [NRP]. Bounding comprises of but not limited to working conditions, living / surrounding environment, personnel perception and knowledge enhancement, life style, food habits. HEQGS makes the cognitive decision through the database of various patient records and their medical history.

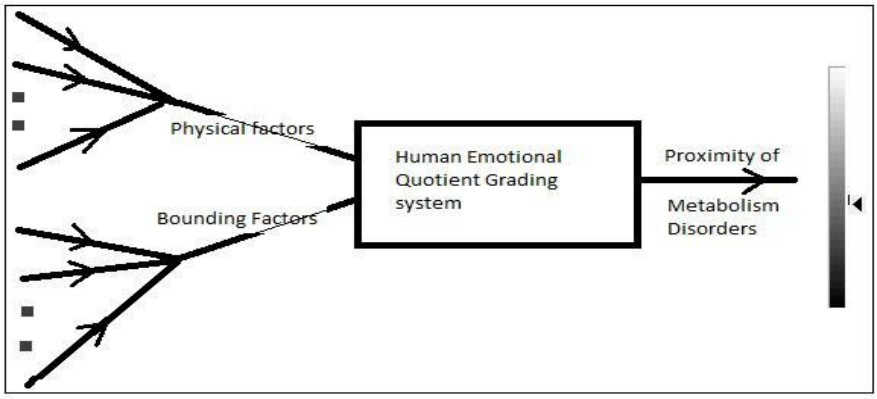


Figure 1: Black box model for HEQGS

B. Decisive Capability of HEQGS

HEQGS has the diagnosed database of various patients and their medical history: the database has records in the following split-up.

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{1_patient ID, 2_diagnosed disorder, 3_date of disorder confirmation, 4_persistence of the disorder, 5_duration existence of the disorder, 6_decisive factors used, 7_physical factors, 8_bounding factors, 9_control over the disorder in percentage, 10_ additional complications developed, 11_ behavioral factors, 12_till date duration of the disorder, 13_control period, 14_genetic disorders, 15_drug effect and drug persistence}. The above listed data are then broadly categorized into Pulling Factors [PF] and Favoring Agents [FA].

C. Various Human Emotional Quotients [HEQ]

Human Emotional Quotient are numerous and counting. Below is the partial list of various HEQ's. Anger, Affection, Addiction, Dominance, Enthusiasm, Engraving, Happiness, Misbehavior, Sorrow, Depression, Excitement, Hesitation, Vagueness, Aggression and so on. HEQ's are the indicators of an ongoing internal imbalance. Their persistence after the onset of imbalance helps in determining the withstanding capability of a person. We call this capability as HEQ responsiveness. Human body uses emotions to filter out "Incurred Excessive On setting Imbalance".

II. RELATIONSHIP BETWEEN HEQ AND METABOLISM DISORDERS

A. Metabolism Disorders

Human body needs energy to be fed to functional parts in the form of calories. Calories are released by transforming [i.e. burning] the stored fat reservoir. This can be related with the combustion engine which pressurizes a fuel drop and transforms the controlled combustion into motion. Body stores the excess energy in the form fat for future use, which are extracted from the food intake. Metabolism is a balanced phase which uses this fat in prolonged equi distribution. When this equi distribution / conversion of energy are disrupted, it results in improper metabolism. Properness in the metabolism can be compared with mileage of a combustion engine.

Metabolism disorders are being governed by broad category of factors such as physical factor and bounding factor. The correlation of HEQ and Metabolism Disorder can be explained through the identified "Pressure cooker effect".

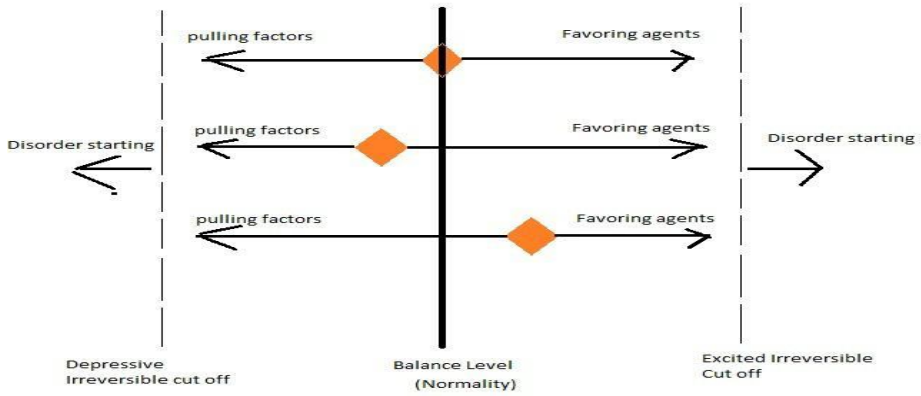
B. Pressure Cooker Effect

The underlying working principle of pressure cooker is to keep the on setting depression in balance. A pressure cooker has components known as additive components or soothers to cook along the main course. The cooker is been constantly heated, because of this constant heat pressure inside develops and subsequently enter into a high pressure state. In order to keep the existing setup in balanced equilibrium state, the high pressure is being spitted out in a burst of time.

As and when needed, the developing inside pressure is released out at decreasing intervals. But if the heat is kept in constant grades [i.e. in a non-subsidized state], the Pressure Cooker [PC] might enter into a non-reversible bursting state. The scenario explained above can be correlated with emotional outburst as well. In humans, the emotional outburst is the result of keeping the on setting pressure / imbalance in balance. As the pressure cooker is getting constantly heated up, emotions are kindled by external environments. We call these external environments as Favoring Agents [FA]. As the pressure cooker releases the excess pressure, Human system also releases the emotional outburst. The pressure releasing decreasing interval can be related the withstanding capability of a subject.

III. EQUATION BETWEEN PULLING FACTORS [PF] AND FAVORING AGENT [FA]

Pulling Factors [PF] and Favoring Agents [FA] pull each other like in tug-of-war to keep the system in balance.



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Figure 2: Pulling Factors and Favoring Agent

As in pendulum, which swings a lot before come to rest, the balance level marker also swings before resting in normality. When the marker enters either the "Depressive Irreversible Cut-off" or "Excited Irreversible Cut-off", the chances of keeping the system in balance fails. This is where the human body enters into the irreversible metabolism disorder like diabetes mellitus and thyroids. Equilibrium Level [EL] = PF – FA.

EL = { = 0 □ Normal Metabolism
>0 □ Depression starts / internal pressure builds up
<0 □ Body enter into excited state.

IV. SWINGING PATTERN OF BALANCE LEVEL MARKER BETWEEN PF AND FA

The Balance Level [BL] Marker Swing in between the "Depressive Irreversible Cut-off" and "Excited Irreversible Cut-off" and slowly comes to rest as in pendulum motion. The swinging pattern of BL marker increases in the peak approaching time. It decreases in the rest approaching time.

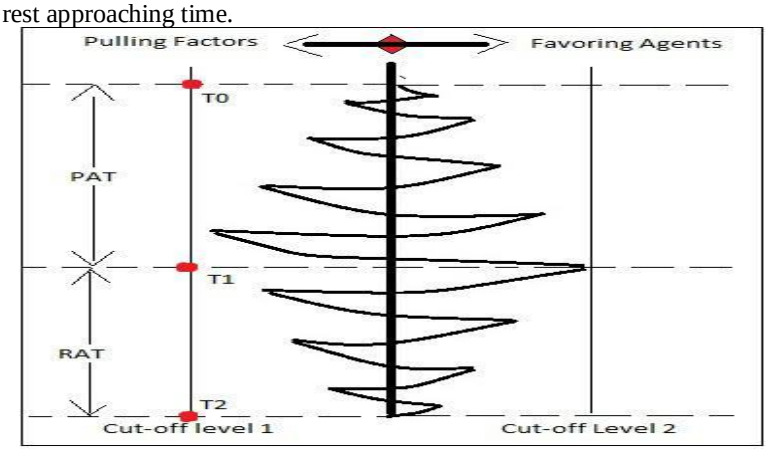


Figure 3: Swinging Pattern of Emotional Outburst

From the figure it is evident that, T0 → time when the depression starts. T1→ Time when emotional Outburst occurs. T2 → Time when normality returns. The duration from T0 to T1, we call it as Peak Approaching Time [PAT] and the duration form T1 to T2, we call it as Rest Approaching Time [RAT].

The cumulative Emotional Duration [ED] is calculated by combining PAT and RAT. ED is having close relation with physical properties of Human Body. The physical properties consist of hormonal activity, trained behavioral pattern of body like smoking – drinking – food habits, Heredity / Gene pattern.

Bird's eye view study of time duration in various patients, who are diagnosed with close proximity towards diabetes mellitus reveals, higher the duration of ED, higher the probability of Metabolism disorders. Persons having less responsiveness towards external stimulus, succumb less to disorders.

A. Measuring Duration of Imbalance Persistance

The duration of imbalance [ED] can be measured using Neural Responsive Pattern [NPR] not by physically exciting a person. NRP is the magnetic induction disruption obtained from brain signals through head cap. In short this is called as EEG [Electro Encephalo Gram].

Study reveals that EEG pattern differs between normal Emotional Quotient and Excited Emotional Quotient. Pin pointing the corresponding pattern of a person in an investigative full day cycle and studying the time between two extremes of excited cut-off levels at various parts of time of a day, helps us to decide the existing metabolism of a person and the proximity towards disorders.

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V. ELECTRO ENCEPHALO GRAM AND EMOTIONAL QUOTIENT:

EEG, or electroencephalogram, is a tool used to image the brain while it is performing a cognitive task. This allows us to detect the location and magnitude of brain activity involved in the various types of cognitive functions. EEG allows us to view and record the changes in brain activity during the time a task is performed. Images are acquired by using electrodes to monitor the amount of electrical activity at different points pinned to the scalp. We have given below a sample EEG response, when a patient is diagnosed.

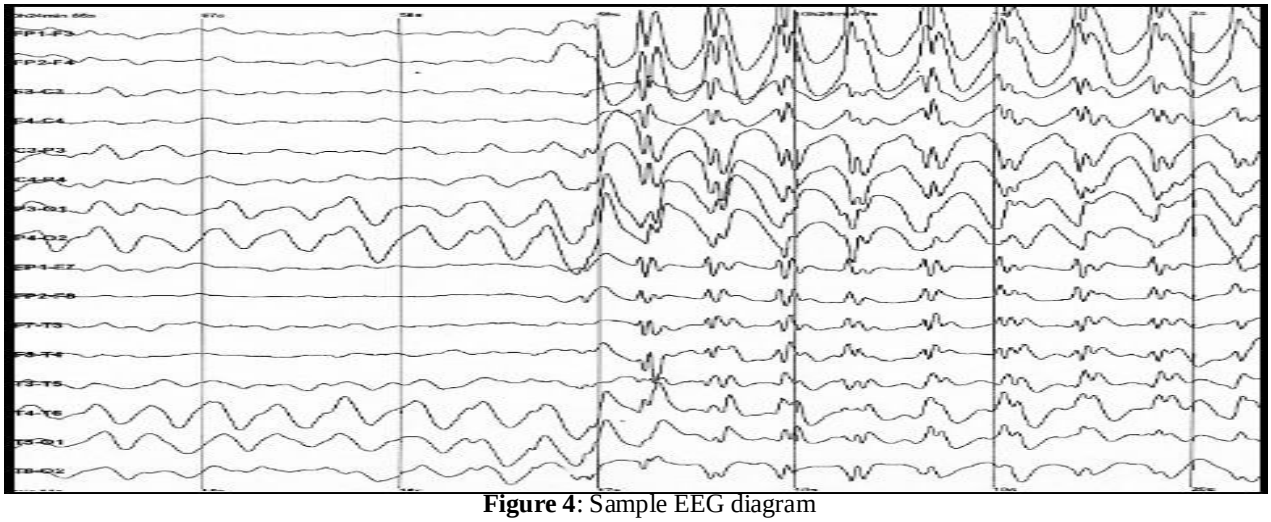


Figure 4: Sample EEG diagram

EEG is the response of a subject's continuous Cognitive imbalance. This cognitive imbalance for a particular duration is having the combined emotional imbalance and also the non-responsive normal state. By repeatedly taking EEG for the subject under consideration or comparing the EEG's of majority of likely subject's, we can identify the parts that are seemingly same. This seemingly equal part of an EEG represents Emotional Quotient Region [EQR].

A. Relationship between Emotional Quotient Region [EQR] and Metabolism Disorders

When EL [Equilibrium Level] is normal, it indicates that balance prevails. At this state the pulling factor and favoring agents are balancing each other. At the negative EL state the pulling factor gets strength over the favoring agents, whereas in the Positive EL state the favoring agents gets strength over the pulling factors.

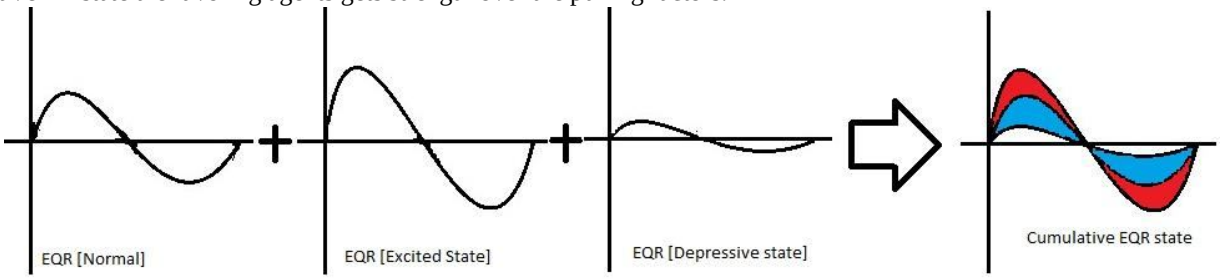


Figure 5: Emotional Quotient Region [Normal, Depressive, Cumulative]

The blue colored shaded region below the normal curve indicates the depression region. The red colored shaded region above the normal indicates the excited region. Time of this instance of EQR is called as "EQR outburst Instance". Slowly, as the pendulum swings, both the excited and depression region starts to diminish in size. Time of this instance when the Cumulative EQR becomes normal EQR is noted and is called as "EQR Retainment Instance". The difference "EQR Retainment Instance" and "EQR Outburst Instance" indicates the persistence time of internal imbalance. Experimental results adjudicate that:

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"Lesser the **Persistence-Time - of – Internal – Imbalance, higher** the **Withholding – capability.** Higher the **Withholding – Capability** lesser the chances of **Metabolism – Disorders".**

$$\text{Persistance Time of Internal Imbalance} \;\alpha\; \frac{1}{\text{Withholding Capability}} \;\alpha\; \text{Metabolism Disorders}$$

This states that persistence time and proximity of disorders are having linear proportionality.

B. Interpretation of EQR using Minimal Data

1) *Case 1: Predicting the "Likely-to-become" Factor:* This factor helps in determining the proximity or probability of a normal person getting into the metabolism disorders. The relative retainment to normality in EQR gives the proximity or percentage for "Likely-to-become" factor. Higher the factor indicates that the subject's possibility of developing into metabolism disorders is higher. The EQR [Excited] and EQR [Depression] helps in determining the Excited Irreversible Cut-off and Depressive Irreversible Cut-off Level respectively.
2) *Case 2: Diagnosing the Control using "Likely-to-worsen" Factor:* When the EQR [Excited] and EQR [Depression] goes beyond the predefined extreme cut-off levels, the time duration of EQR going beyond the extreme levels is noted. This time duration is called as "Cut-off crossing duration". Higher the "Cut-off crossing Time" lesser is the control over the existing disorder through drugs.
3) *Case 3: Determining the "Likely-to-become-Retarded" Factor:* In both the above cases, the swinging pattern along the pulling factor and favoring agent region, , is uniform irrespective of whether the pattern is within the cut-off levels or beyond the cut-off levels. The abnormal / non-uniform swinging pattern indicates the person's chances of becoming mentally retarded are higher.

VI. COMPILED TEST RESULT WITH MINIMAL PATIENT DATA:

HbA_1C is the factor used in diabetes Mellitus to determine the control a patient possess over the previous months. A bar chart is plotted between HbA_1C and Persistence Duration over the period of one year based on the collected medical data. The chart also reveals partially that Higher the EQR Persistence duration lesser is the control over the existing disorder.

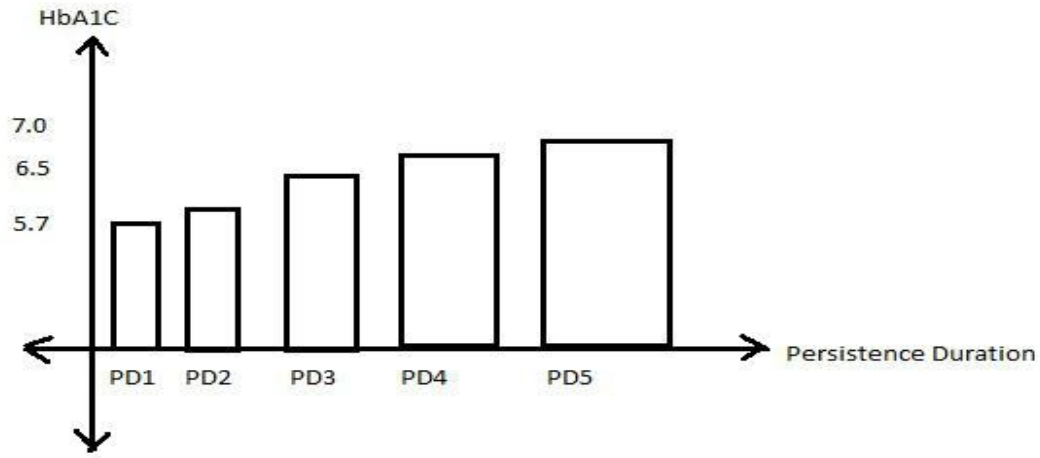


Figure 6: Bar chart [HbA1C Vs Persistence Duration]

In the figure above, 5.7 is the normal reference level of HbA1C, 5.7 to 6.4 indicates the Pre-diabetes reference levels, beyond 6.5 indicates diabetes levels. PD1, PD2, PD3, PD4, PD5 indicates the increasing duration of Persistence Duration. This result is a partial result obtained using minimal patient data obtained from a hospital as part of a pilot project called "Diagnose Diabetes and Emotional Quotient".

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VII. FUTURE WORK AND CHALLENGES

Using the EQR and its associated factors like persistence duration and cut-off crossing duration, a minimized EEG head cap and a diagnoser can be designed. Instead of using invasive, non-general, clinical technique such as HbA1C, this head cap is used to pin point the vulnerability and control of the metabolism in a person.

Diagnosing the EQR region and identifying the QR region from the EEG needs heavily populated reference EEG's, which eventually will formulate a database of medicinal history and a compiled EEG for prolonged duration and investigation.

VIII. CONCLUSION

In recent days the chances of a person developing into metabolism disorder like diabetes mellitus and thyroids is growing manifold. These disorders are the result of food habits, behavioral aspects (ex. Smoking, drinking), hormonal ineffective responsiveness and also genetic factors. Till date there exist only very few but ineffective techniques to predict the likeliness of these disorders. Invasive techniques are used for accomplishing these diagnostic purposes. They are not handy. Technique such as Emotional Quotient Region Grader, use non-invasive techniques and can be made affordable as well as made handy, which by the way provides constant monitoring of the disorder and by the way carving towards Human Emotional Quotient Grading System [HEQGS].

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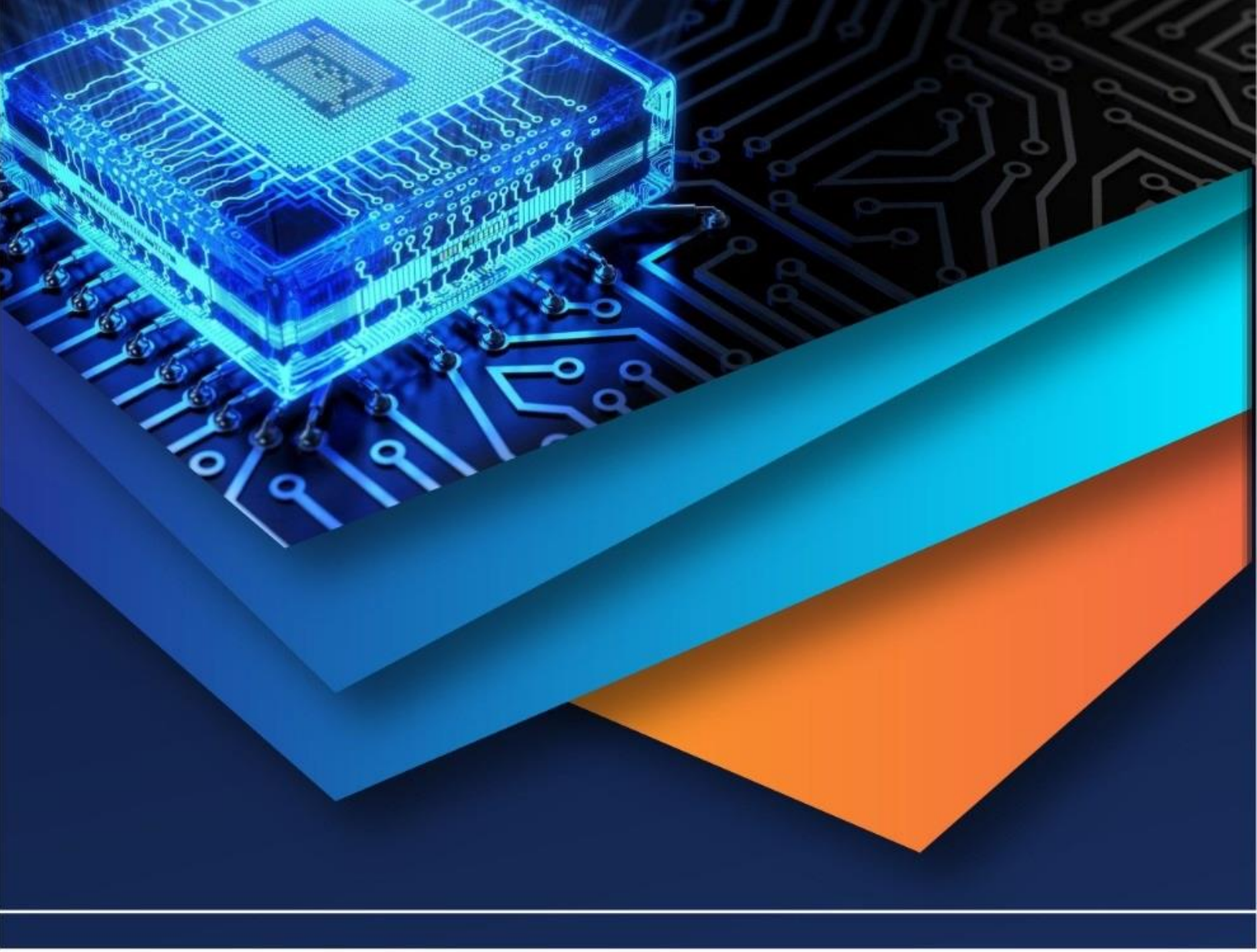
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