



## BRAIN SIZE ANALYSIS SYSTEM USING MACHINE LEARNING ALGORITHM

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### Abstract

Identical twins are referred as Monozygotic twins (MZ). MZ twins formed from a single zygote. The zygote divides into two equal halves, each of which grows independently into an individual of the same sex and genetic constitution as the other. MRI and quantitative image analysis techniques were used, many studies shown the relationship between neuroanatomic similarities in MZ twins and head size, brain size, and intelligence quotient (IQ). In proposed study we applied linear regression algorithm to find the correlation between Forebrain volume, cortical surface and callus area to show the best precision. By reducing the error, this method can find the line. The distance between the line and the point is the error of each point. The study showed that there is no significant correlation between IQ and brain or head circumference measurements. These results indicate that the forebrain volume, cortical surface, and callus area of the MZ twins are similar, and the brain measurements are closely related to each other and closely related to head circumference. But it has nothing to do with the IQ of healthy young people.

**Keywords:** Monozygotic twins (MZ), Intelligence quotient (IQ), Brain size.

### I. INTRODUCTION

Monozygotic (MZ) twins display similitude in equipment enamel local skills and different social characteristics which are inferable, generally, to the person in their characteristics. One may also assumption that MZ twins have likenesses in cerebrum existence structures. As of now no longer lengthy ago, it's been difficult to check this hypothesizer in quantity. Use in vivo imaging methods as medical tools last sector century has been the development of PC primarily based totally photo getting ready techniques that supply quantitative investigations of neuroanatomic records contemporaneously with social appraisal. In the present day examination, we broke down entire forebrain volume, all out cerebral cortical surface region, callosal cross-sectional region, head boundary, and full-scale (IQ) in regular grown up MZ twins. As properly as surveying co-twin similitude, we attempted for correlations amongst thoughts measures, head perimeter, and IQ. Monozygotic twins (MZ) show likenesses in psychological abilities and other social qualities that are inferable, generally, to the personality of their quality. Considering current information about cerebrum conduct connections in systems fundamental mental health in creature, one may theorize that MZ twins have similitude's in mind life structures. As of not long ago, it has been hard to test this theory quantitatively. With the appearance of in vivo mind imaging as a clinical device over the past 25 years has been the improvement of PC based picture handling strategies that license quantitative examinations of neuroanatomic information contemporaneously with social evaluation. In the current investigation, we examined all out forebrain volume, complete cerebral cortical surface region, callosal cross-sectional region, head circuit, and full-scale (IQ) in ordinary grown-up MZ twins. In our proposed framework, we utilized a straight relapse calculation and noticed an extremely huge genotypic impact; however there was no critical impact on the birth request. The all out forebrain volume, all out cortical surface and cross-sectional callus region were diverse among disconnected sets than in twins. Co-twins had been also more important equivalent than random sets with respect to move circuit and IQ. In mind length the connection among head length and mind length in healthful adults stays uncertain. The relationship between head size and brain size in healthy adults is still problematic. We tracked down that in our 18 to 43-year-elderly individuals; there is a solid connection between the head limit and the forebrain volume, and between the head border and the cortical surface region.

## II. REALTED WORK

Dana A et.al [1]. He proposed In Theoretical graph analysis is suitable for rsFC measurement. Track is used to determine the number of tracks as an indicator of structural bonding strength. Compared with twins with higher BW, twins with lower BW have lower connection efficiency to the edge network, which is due to the difference in efficiency on the right side. Hippocampus and right amygdale. Ji YoonHan et.al [2]. He designed Identical twins exhibit slightly different clinical, cognitive, and behavioral phenotypes. Pathological clinical manifestations such as seizures, scoliosis, enlarged ventricles, and attention deficit/hyperactivity disorder (ADHD) were found in the test subject (first twin), but not in his brother (second twin) Find. We used diagnostic exome sequencing (DES) to detect de novo heterozygous NSD1 mutations in identical twins with Soto's syndrome. ChunyanLi et.al [3]. He worked on to analyze the difference in white matter network (WM) topological characteristics between identical twins with ASD (MZCoASD) and normally developing children (DT). We have recruited 67 people between the ages of 2 and 9. Clinical evaluation and diffusion tensor imaging (DTI) were completed on 23 MZCoASD and 21 TD only children. Use drawing theory to compare the topological characteristics of the TM network between the two groups, and analyze its correlation with the severity of clinical symptoms. Bidelman GM et al [4].He found a recent large study of 11,000 twin sets from four countries showed a linear increase in the heritability of intelligence from 41% in childhood (9 years) to 55% in adolescence (12 years) and to 66% in young adulthood (17 years). Bouchard TJ et al [5]. From the study it is found in Siblings reared together in the same home have IQ's that are more similar than those of adopted children raised together in the same environment, There is growing interest in the potential for epigenetics (a stably heritable phenotype

DNA sequence) to influence cognition. Kanazawa S et al [6]. He proposed The IQ of an individual is multifactorial and is determined by a multitude of factors. Nature and nurture work together in determining human intelligence. Even though the genetic susceptibility plays a crucial role on the IQ of the individual, various modifiable environmental factors like education, premature birth, nutrition, pollution, drug and alcohol abuse, mental illnesses, and diseases can have an influence on an individual's IQ. These modifiable factors can reinforce or weaken genetic susceptibility. Martin NG et al [7]. He worked on another study support the view that apparent effects of breast-feeding on IQ reflect differential likelihood of breast-feeding as a function of parental education and did not support the predicted interaction effect of FADS2 and breast-feeding on IQ. Haggarty P et al[8]. He considered Such epigenetic 'heritability' may occur through either mitosis or meiosis and therefore has the potential to explain at least part of the high heritability of intelligence. The role of epigenetics in human complex traits such as intelligence is difficult to study for a number of reasons. Epigenetic status can be influenced by factors such as diet and alcohol therefore, depending on the epigenetic mark of interest. DNA methylation is probably the most commonly studied epigenetic phenomenon. Polymorphisms were measured in the four DNA methyltransferase: DNMT1 DNMT3A DNMT3B DNMT3L. There was a significant association between the DNMT3L 11330C>T variant and childhood intelligence. The relationship between DNMT3L and adult intelligence was only approaching statistical significance after Bonferroni adjustment therefore the primary finding here is in relation to childhood intelligence. The potential involvement of epigenetics and imprinting in particular, raises the intriguing possibility that even the heritable component of intelligence could be modifiable by factors such as diet during early development.

## III.METHODLOGY

The basic principle of algorithm that every machine learning enthusiast starts out with a linear regression algorithm, so we'll do the same as it gives us a foundation for developing and learning other machine learning algorithms.

### Linear Regression:

Forward regression is a controlled AI calculation in which the expected performance is consistent and has a constant slope. It is used to predict values within a constant range rather than trying to group them based on classification. It is used to measure real-world quality as a function of constant variables. Here we link the freedom factor and the protection factor to create the best route. This best-fitting straight line is called the descending line and is solved by the direct condition  $Y = a * X + b$ . The most ideal approach to comprehend straight relapse it is to remember that experience of youth. Assume you ask fifth-graders to organize the people in their group by expanding the weight query without asking what they are doing. What do you think the child will do? You will almost

Certainly focus on (external analysis) the growth and performance of people, and organize them based on a mix of these obvious constraints. In fact, this is a direct relapse! The youngster has really sorted out that tallness and construct would be connected to the load by a relationship, which resembles the condition above.

- Simple Linear Regression
- Multiple Linear Regression

### Simple Linear Regression:

We discussed how Linear Regression is a simple model. Basic Linear Regression is the simplest model in AI. A direct relapse calculation is called basic straight relapse in case it is having just a single free factor. Basic direct relapse utilizes conventional slant capture structure, where m and b are the factors our calculation will attempt to "learn" to deliver the most precise forecasts. X addresses our info information an addresses our expectation.

$$Y=mX+b$$

m – Slope

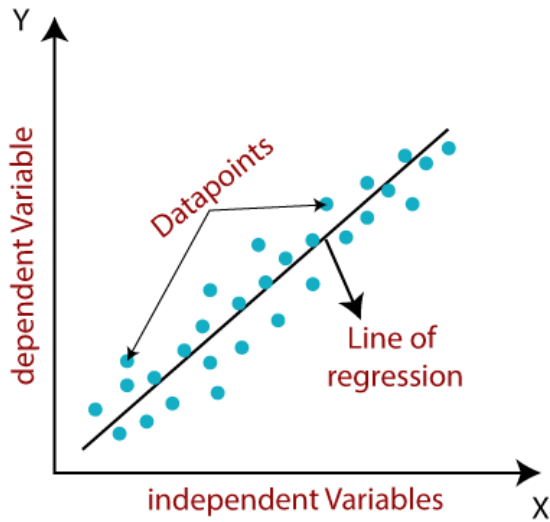
X – Independent Variable

b – Intercept

Y – Dependent Variable

**Least Square Method:** Earlier in this article, we discovered that we did not use a line to represent the exact relationship between X and Y. Suppose we don't have many data sources and returns. In addition, we track these diffuse focal points in a two-dimensional space; we will get something similar to an attached picture. You can also see the lines in the picture. We will achieve this goal. We also need to limit the defects in the model. A decent model always has the smallest flaws. We can see this line by reducing the error. The error of each point is the distance between the line and that point. This is shown below.

IV. RESULTS



Linear Regression

Multiple Linear Regressions

A straight relapse calculation is called various direct relapse in case it is having more than one free factor. A more perplexing, multi-variable straight condition may resemble this, where w addresses the coefficients, or loads, our model will attempt to learn. Numerous Linear regressions is a type of linear regression in which information has various features (variables).

$$f(x,y,z)=w1x+w2y+w3z$$

The factors x,y,z address the traits, or particular snippets of data, we have about every perception. For deals forecasts, these characteristics may incorporate an organization's publicizing spend on radio, TV, and papers.

Model Representation

Like In simple linear regression, we have an input variable (X) and a performance variable (Y). However, the info variable has nn highlights. Accordingly, we can address this direct model the following;

$$Y= \beta_0+\beta_1x_1+\beta_1x_2 +.... +\beta_nx$$

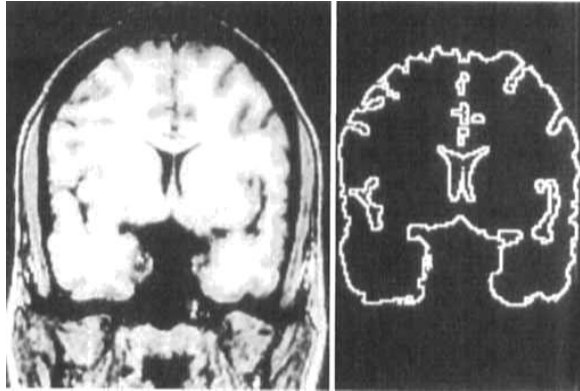


FIGURE 1: Example of a T1-weighted coronal section through the frontal and temporal lobes (left) and the corresponding pial and ventricular outlines (right) used in total forebrain volume analyses.

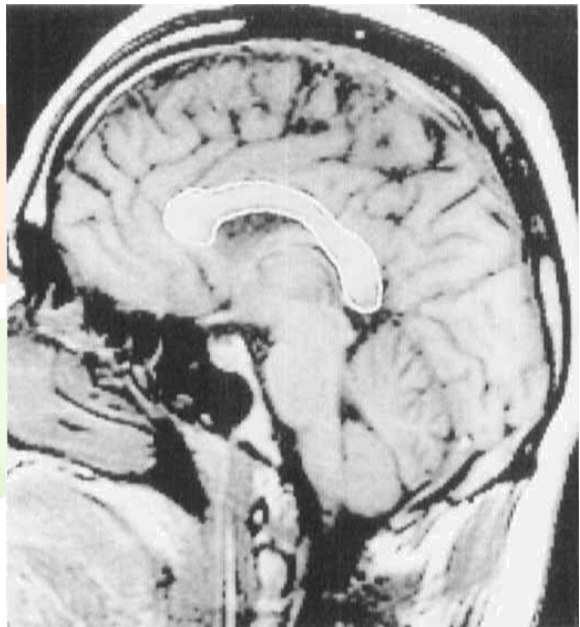


FIGURE 2: Example of T1-unweighted midsagittal MRI showing outline of the corpus callosum used in cross-sectional analyses.

**Total forebrain volume:** There were exceptionally huge (  $p < 0.01$ ), effects of genotype for both crude forebrain volume ( $F(9,9) = 19.49, p < 0.0001$ ) and forebrain volume standardized by genotype impact for both crude head boundary ( $F(9,9) = 14.30, p = 0.0003$ ), showing extraordinary variety across inconsequential sets. No huge impacts of body weight ( $F(9,9) = 16.80, p < 0.0001$ ). No birth request birth request were found for one or the other measure (crude,  $F(1,9) = 0.71, p = 0.42$ ; typical  $0.22, p = 0.65$ ; standardized,  $F(1,9) = 0.04, p = 0.84$ ), indized,  $F(1,9) = 0.70, p = 0.42$ ). There was a sex impact for eating little variety inside co-twins. No huge impact crude head outline except for not for standardized head circuit impacts of sex were found (crude,  $F(1,8) = 1.29, p = 0.29$ ; periphery (crude,  $F(1,8) = 7.48, p = 0.03$ ; standardized,  $F(1,8) < 0.01, p = 0.98$ ), showing little variety,  $F(1,8) = 0.11, p = 0.75$ ). The genotype impacts remained variety among ladies and men. The exceptionally critical impacts subsequent to adapting to sex contrast across impacts of genotype persevered after the commitment of sex irrelevant sets (crude,  $F(8,9) = 8.63, p = 0.002$ ; standardized, contrasts across inconsequential sets were eliminated (crude,  $F(8,9) = 18.65, p < 0.0001$ ).

- **Total cortical surface area.**

The example of results for cortical surface region was like that for forebrain volume. There were profoundly critical genotype impacts for both crude cortical surface region ( $F(9,9) = 8.66, p = 0.002$ ) and cortical surface region standardized by body weight ( $F(9,9) = 9.96, p = 0.001$ ), showing extraordinary variety across disconnected sets. There was a pattern raising the chance of a feeble birth request impact for crude cortical surface region ( $F(1,9) = 3.76, p = 0.08$ ) however not really for standardized cortical surface region ( $F(1,9) = 0.83, p = 0.39$ ), demonstrating generally little variety inside co-twins, particularly when body weight was considered. No critical sex impacts were found (crude,  $F(1,8) = 0.01, p = 0.93$ ; standardized,  $F(1,8) = 0.77, p = 0.41$ ). The exceptionally huge genotype impacts endured subsequent to adapting to sex contrasts across inconsequential sets (crude,  $F(8,9) = 9.73, p = 0.001$ ; standardized,  $F(8,9) = 10.23, p = 0.001$ ).

- **Correlations between measures.**

A relationship lattice for all crude and standardized measures is displayed in table 2. All pair shrewd connections between's forebrain volume, cortical surface region, callosal region, and head boundary were positive and critical, with  $r$  esteems going from  $0.51, p = 0.0222$  to  $0.95, p < 0.0001$ . The direct relapse of crude cortical surface region on crude forebrain volume is outlined in figure1 (cortical surface region =  $585 + 1.04$  forebrain volume;  $r = 0.77, B^2 = 0.59, p < 0.0001$ ). No critical connections among's IQ and either forebrain volume, cortical surface region, callosal region, or head circuit were found ( $r$  range =  $-0.06$  to  $+0.20$ ; all  $p > 0.40a$ ). For the subpopulation of 10 disconnected people, pair shrewd relationships between's cerebrum measures were something very similar in sign and comparable in extent, and all stayed huge ( $r$  range =  $0.63$  to  $0.96, p = 0.0492$  to  $p < 0.0001$ ), with  $r = 0.76$  for crude forebrain volume and cortical surface region ( $p = 0.0111$ ) and  $r = 0.94$  for standardized forebrain volume and cortical surface region ( $p < 0.0001$ ); connections between's head perimeter and mind measures were likewise something very similar in sign and comparable in greatness, with all standardized means and crude head periphery and callosal region arriving at importance ( $r$  range =  $0.72$  to  $0.94$ ;  $p$  range =  $0.0181$  to  $x < 0.0001$ ), crude head outline and forebrain volume showing a pattern ( $r = 0.62, p = 0.058$ ), and crude head

circuit and cortical surface region falling beneath importance ( $r = -0.48, p = 0.164$ ). Once more, no huge relationships among's IQ and forebrain volume, cortical surface region, callosal region, or head perimeter were found ( $r$  range =  $-0.26$  to  $0.25, p > 0.47$ ).

## DISCUSSION

For all mind means, there were exceptionally critical genotype impacts yet no huge birth request impacts, demonstrating that absolute forebrain volume, complete cortical surface region, and callosal cross-sectional region shifted definitely more across irrelevant sets than inside co-twins. Steady with the aftereffects of past twin examinations, co-twins were additionally more comparable than inconsequential sets concerning head outline 1 and IQ.4 Genotype impacts were not inferable from sex contrasts across random sets.

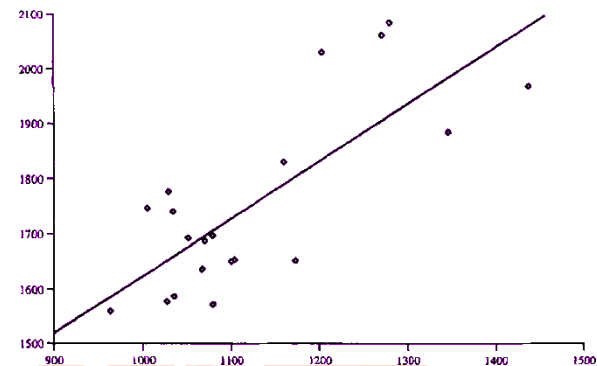


FIGURE 3: Linear regression on [cortical surface area (CSA) on forebrain volume]

The utility of contemplating human twins in clinical examination has been recently checked on by considering the broad writing concerning phenotypic likenesses between MZ twins raised separated, we decipher the current discoveries as proof that pre-birth impacts on mental health in people are adequately solid to be noticeable at the gross morphologic level in vivo utilizing MRI. This understanding is supported by information that the size and state of the grown-up cerebrum arise primarily from cell and physiologic occasions that happen during pre-birth life. In people, cortical neurogenesis starts around the center of the main trimester and closures around midgestation. "Cortical surface region builds 30-crease and cerebrum volume 60-overlap from the start of the second trimester to birth." "Cortical fissuration starts around the fourth seven day stretch of life and nearly arrives at the grown-up structure by birth. The quantity of callosal axons increments by four significant degrees from the main trimester to 5 months after birth.

Our strategies don't permit us to separate the overall commitments of hereditary and maternal components to pre-birth effects on cerebrum size, head size, and IQ. More tight control of maternal factors in imminent examinations would diminish the danger that co-twin likenesses opposite similitudes in dietary, mechanical, compound, or other factors. The shortfall of huge birth request impacts among our outcomes contends against the presence of pathologic intrauterine variables that may have in any case clouded co-twin similitudes.

Similitudes in post pregnancy climate might have added to the noticed co-twin likenesses. Mind volume and cortical surface region increment two to triple from birth to adulthood, and callosal region increments around 40 to 60% from youth to youthful adulthood. Future examinations of cerebrum size, head size, and IQ between MZ twins raised together and MZ twins raised separated would allow assessment of post pregnancy



impacts. Despite the fact that it is by and large held that post pregnancy impacts swell appraisals of hereditary effects on co-twin similitudes, a few creators have contended that post pregnancy impacts might prompt underestimations of hereditary impacts.

[8] Haggarty P, Hoad G, Harris SE, Starr JM, Fox HC, et al. (2010) Human intelligence and polymorphisms in the DNA methyltransferase genes involved in epigenetic marking.

## V. CONCLUSION

Our data on the similarity of brain size and IQ of twins, together with the lack of correlation between brain size and IQ, indicate that the similarity of intelligence of MZ twins cannot be explained by neuroanatomical similarity. This is still reasonable, and we think it may be the genetic influence on brain tissue (that is, how the brain works, not just its size), which is the basis for the intellectual similarity of the MZ twins, which is expressed as a localized level at a rough morphological level. Folding similarity The geometric shape of the left cerebral cortex controls the language and abstract thinking of the vast majority of people. It represents the cognitive ability of our species in the evolution of primates, and is most conducive to the performance of IQ tests, understanding the influence of genetics on intellectual function may be reflected in regional indicators, rather than in the global indicators of brain size or in addition, reflecting the general view that intelligence of certain forebrain distributed on it.

## REFERENCES

- [1] Dana A. Hayward, Florence Pomares, Kevin F. Casey, Elmira Ismaylova, Melissa Levesque, Keelin Greenlaw, Frank Vitaro, Mara Brendgen, Felix Rénard, Ginette Dionne, Michel Boivin, Richard E. Tremblay, Linda Booij, "Birth weight is associated with adolescent brain development: A multimodal imaging study in monozygotic twins", 2020
- [2] Ji Yoon Han, In Goo Lee, Woori Jang, Soyung Shin, Joonhong Park, Myungshin Kim, "Identification of a novel *de novo* nonsense mutation of the *NSDI* gene in monozygotic twins discordant for Sotos syndrome", 2017
- [3] Chunyan Li, Yun Li, Linyan Fu, Yue Wang, Xin Cheng, Xiwen Cui, Jiying Jiang, Ting Xiao, Xiaoyan Ke, and Hui Fang, "The relationships between the topological properties of the whole-brain white matter network and the severity of autism spectrum disorder: A study from monozygotic twins", 2021
- [4] Moreno S, Bidelman GM (2014) Examining neural plasticity and cognitive benefit through the unique lens of musical training..
- [5] Bouchard TJ (2013) The Wilson Effect: the increase in heritability of IQ with age.
- [6] Kanazawa S (2012) Intelligence, birth order, and family size.
- [7] Martin NW, Benyamin B, Hansell NK, Montgomery GW, Martin NG, et al. (2011) Cognitive function in adolescence: testing for interactions between breast-feeding and FADS2 polymorphisms.

