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Design and Development of an Algorithm to find the Truncal Imbalance in Scoliosis X-Ray Image

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Abstract: ***Scoliosis is a 3-dimensional distortion in the spinal segment that is typically found in 2-4% of individuals, of which 70% cases are unclear. Scoliosis is a condition wherein the spine is bended sideways. The bend is frequently S-formed or C-shaped. Scoliosis is where human truck is imbalanced because of spinal bend. The Cobb angle estimation to be done physically takes around 20-30 minutes by the bury and intra onlooker. This paper presents to reduce the ambiguity for the medical professionals on deciding the favourable course for the treatment of the patient, the truncal shift prediction may of a great significance. Therefore, an attempt to Detect the AVT, measure the truncal shift of spinal deformity is done manually and based on the truncal shift classify the scoliosis finally store the result in Excel using GUI.***

The image processing methodology used aims at extracting the features of the spinal column in digital X-ray images, so this helps in the measurement of truncal shift. The method starts with image enhancement using median, Weiner, Gaussian filters and then doing the histogram equalization to obtain clear features of the spinal column.

The developed module will extract the features of spinal deformity by manually selecting the region of interest. The values of the truncal shift are displayed in the excel sheet which is maintained as database. The module can be further improved by adding more features of spinal deformity. The module can be used for CT and MRI images in future. The measurement of truncal shift can also be automated as a future scope.

Keywords: Truncal Shift, Vertical Trunk reference line, image processing, AVT

I. INTRODUCTION

Scoliosis is a medical condition with an irregular twist and curvature of the spine. Globally, scoliosis is the most common musculos keletal disorder that affects children between 2 and 3%.[3],Spine looks ' c ' shaped or's ' shaped when viewing the scoliosis patient fr om the posterior (back) view. Scoliosis care depends on factors such as cobb angle and age[3]. It can be treated by either cast , brace or surgery[3]. The element to consider when preparing for the treatment of scoliosis is the thoracic trunk and the coronal balance.The study showed the relationship between coronal balance and thoracic trunk change after scoliosis correction, but the findings were not reliable[3].This paper suggests an attempt to detect an AVT and the perpendicular line is determined man ually by choosing the line from the apex of the thoracic curve and bisecting the line.Truncal shift is characterized as a distance of m ore than 2 cm between the vertical reference line of the trunk and the central vertical line of the scalar [5] .

The human spine is a collection of bones that supports the whole human body frame.It consists of 33 segments of vertebrae, which a re known as thoracic spine, lumbar spine,curvic spine, sacrum and coccyx[2].Treatment decision for the patients with scoliosis is basedonthedegreeof curvature of the spine.At the moment, orthopedic doctors also often discourage the angle of the spine.There is st ill a lack of precision in determaing the cobb angle of the measurement results.This paper suggests an attempt to classify scoliosis us ing watershed algorithms based on spine curvature to improve the accuracy of the findings[5].

Most experiments used AVT classification and detection manually; none of the algorithms were automatically implemented in an en tire module. This main objective of this paper is to detect the AVT, measurement of the truncal shift based on the shift classify the scoliosis and to store the result in excel sheet using GUI

II. METHOD

The main objective is to identify the shift in the trunk caused by scoliosis. The paper involves medical Xray image processing; the procedure is conducted using MATLAB software using image processing techniques.

A. Data Collection

Data were collected in the seetha batheja spine hospital, pre- and postoperative radiographs were obtained from 10 patients with thoracic scoliosis

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B. Detection of AVT

The distance between the center of the thoracic apical vertebrae and c7 plumb line

C. Calculation of Truncal Shift

Thoracic trunk shift and coronal stability are the main features to be considered at the same time as planning remedy for scoliosis. Truncal shift is the shift extra than 2 cm. Truncal shift is the gap between VTRL and CSVL.

1) *Evaluation of Coronal Balance:* Coronal balance is measured by first identifying the C7 bone [5].The distance between the C7 plumb line and CSVL is measured as coronal balance [5]
2) *Evaluation of Thoracic Trunk Shift:* Thoracic shift is measured by first identifying the apical thoracic vertebra [5]. The distance between vertebra and CSVL is measured as thoracic trunk shift.

D. Classification of Scoliosis

Each scoliosis curve is classified into 3 ways:By curve type proximal thoracic, central thoracic and thoracolumnar / lumbar based on the 3 area of the spine

E. Procedure to create the GUI

1) Start the GUIDE
2) Pick the blank GUI prototype in the GUIDE dialog box and then press OK
3) Display the component name in the palette

III. DESIGN AND IMPLEMENTATION

The below given are the steps involved in completion the paper on measuring truncal shift:

1) *Step 1:* Start
2) *Step 2:* Read the input image
3) *Step 3:* Select the image from file format
4) *Step 4:* Apply necessary filters to the image for enhancement.
5) *Step 5:* Detection of AVT in Scoliosis image
6) *Step 6:* To measure the truncal imbalance
7) *Step 7:* Draw two lines across the Thoracic.
8) *Step 8:* Euclidean distance formula and necessary Sobble operators are used to find the distance between the lines.
9) *Step 9:* Classification of scoliosis using BPNN algorithm.
10) *Step 10:* The obtained result is displayed on the excel sheet using GUI.

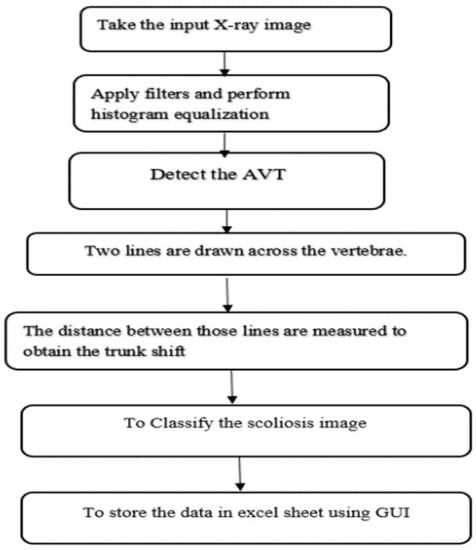

Fig 1: Flow chart to display the truncal Shift

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IV. RESULTS AND DISCUSSION

Processing of digital medical X-ray images and the filters are applied to enhance the image quality. Calculate the truncal shift by drawing the lines from the upper end and lower end of the vertebral column .Above procedure is repeated for more than one patient .Obtained distance for different patients are stored in the excel sheet to preserve the data.

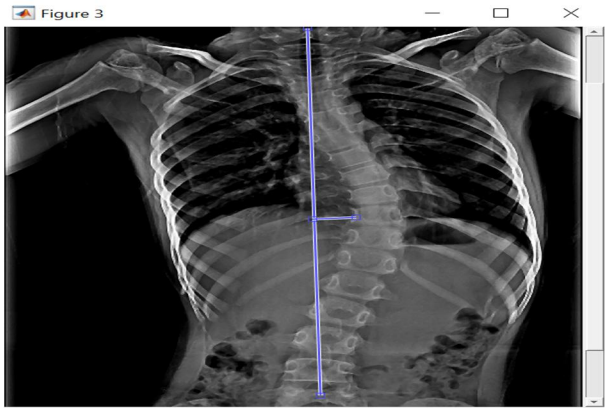
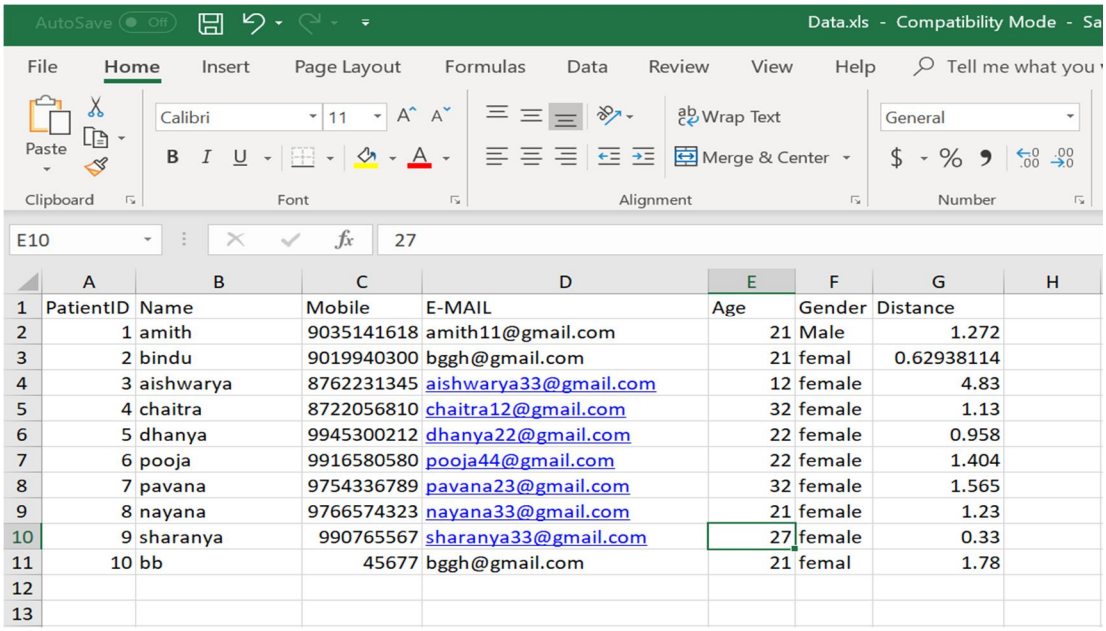


Fig 2 : Measurement of truncal shift from apex of the thoracic curve and bisecting the perpendicular line



	A	B	C	D	E	F	G	H
1	PatientID	Name	Mobile	E-MAIL	Age	Gender	Distance	
2	1	amith	9035141618	amith11@gmail.com	21	Male	1.272	
3	2	bindu	9019940300	bggh@gmail.com	21	femal	0.62938114	
4	3	aishwarya	8762231345	aishwarya33@gmail.com	12	female	4.83	
5	4	chaitra	8722056810	chaitra12@gmail.com	32	female	1.13	
6	5	dhanya	9945300212	dhanya22@gmail.com	22	female	0.958	
7	6	pooja	9916580580	pooja44@gmail.com	22	female	1.404	
8	7	pavana	9754336789	pavana23@gmail.com	32	female	1.565	
9	8	nayana	9766574323	nayana33@gmail.com	21	female	1.23	
10	9	sharanya	990765567	sharanya33@gmail.com	27	female	0.33	
11	10	bb	45677	bggh@gmail.com	21	femal	1.78	
12								
13								

Fig 3: Data stored in Excel sheet

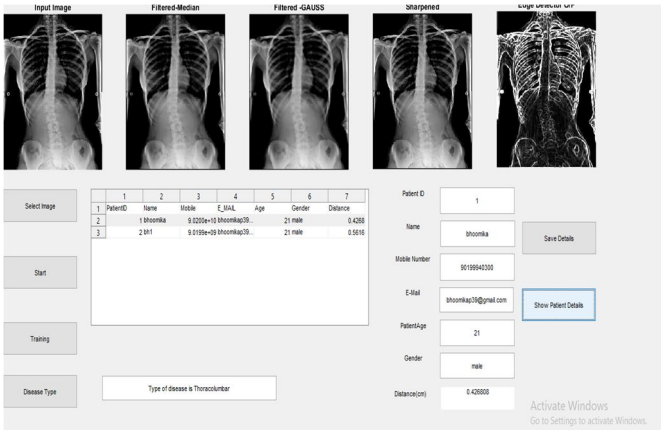


Fig 4: To store the obtained results in data base with GUI.

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V. CONCLUSION

Upon surgical procedure, postoperative trunk shift isn't rare for AIS, with 13.6% of patients in series of which zero. Five% had been iatrogenic. This paper develops a software program module to locate the AVT, the distance between the middle of the apical vertebra and the C7 plumb line, the size of the trunk shift. The gap among the VTRL and CSVL based totally on that distance to become aware of the scoliosis and then store the outcomes in Excel sheet the use of GUI

Numerous studies were carried out based on the measurement of the truncal shift, classification, feature detection, none of the algori thms were manually implemented in this paper proposed to design and develop an algorithm to find the truncal imbalance in the X-ray scoliosis image.

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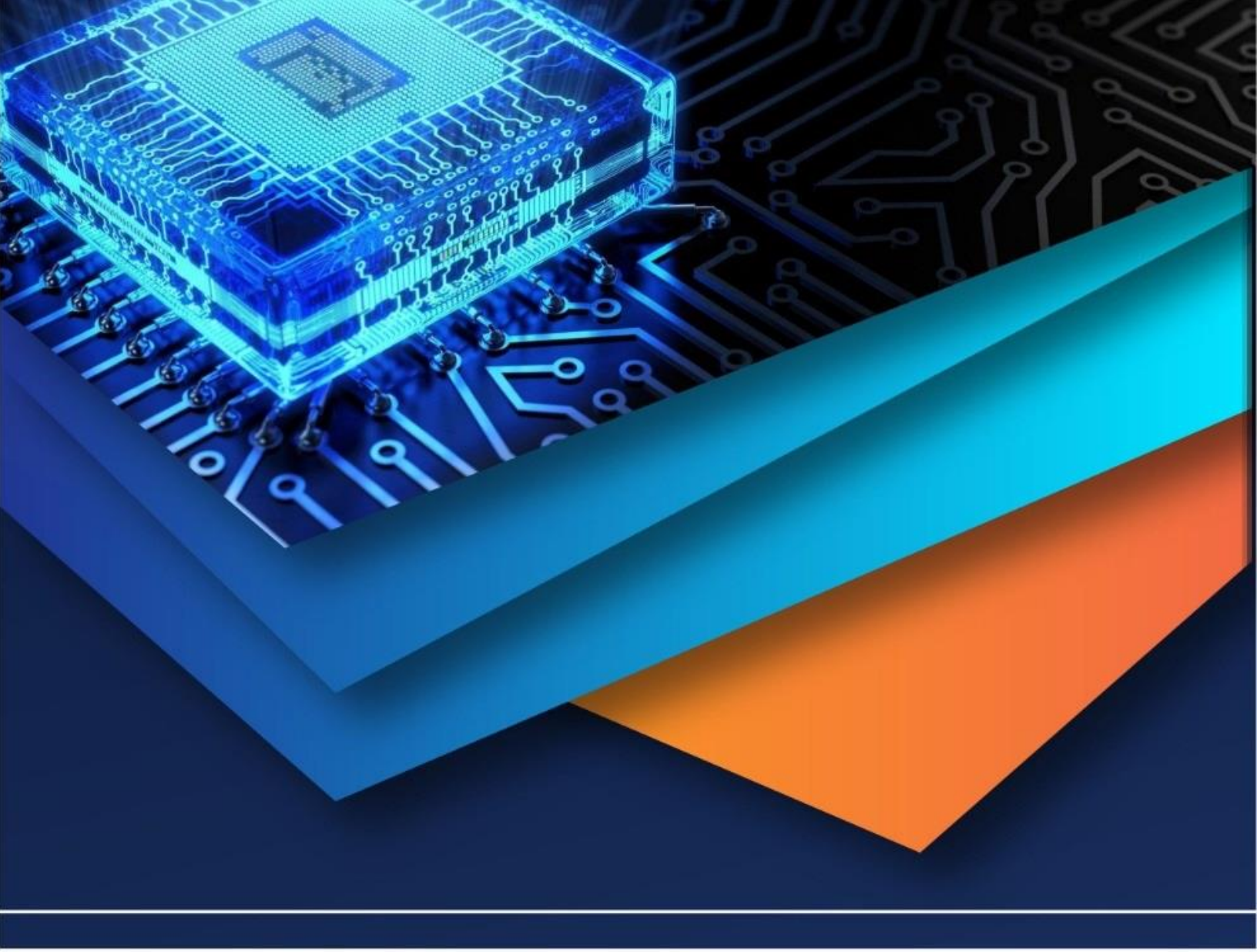

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