3	266.04	99.36
4	227.92	99.25
5	195.49	98.22
6	201.73	98.82
7	45.1	90.78
8	227	99.53
9	173.31	98.99
10	178.62	98.86

Table 1 shows the accuracy achieved for each of the images and the implementation time. The average accuracy attained is 97.6%.

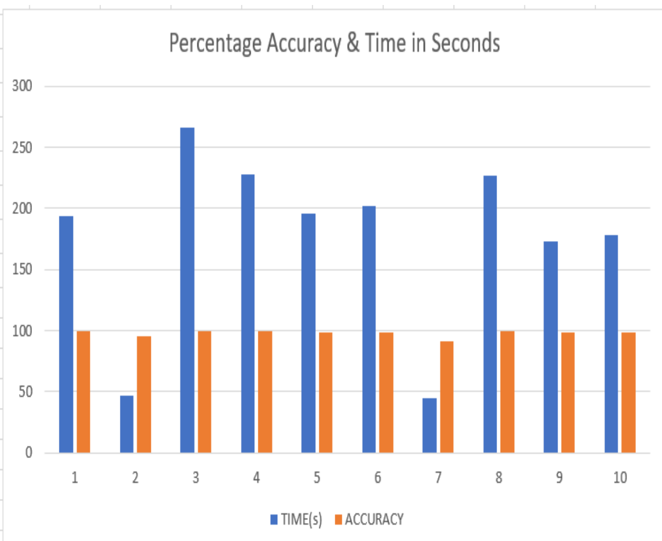
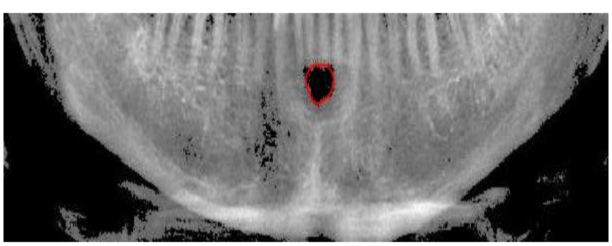
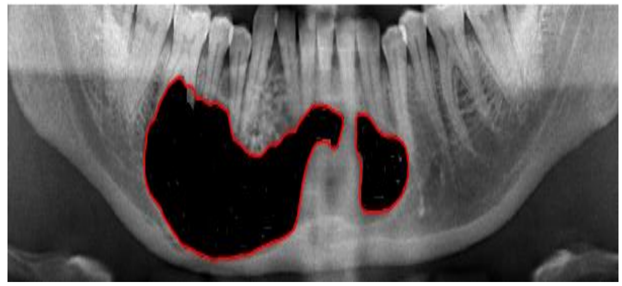


Fig. 3 Plot of Percentage accuracy and time is taken to process images.



(a)



(b)

Fig. 4 Segmentation of cystic regions using geodesic active contour model shown on different panoramic images (a) & (b).

Table 2. depicts the performance analysis for ten images among the segmented data set.

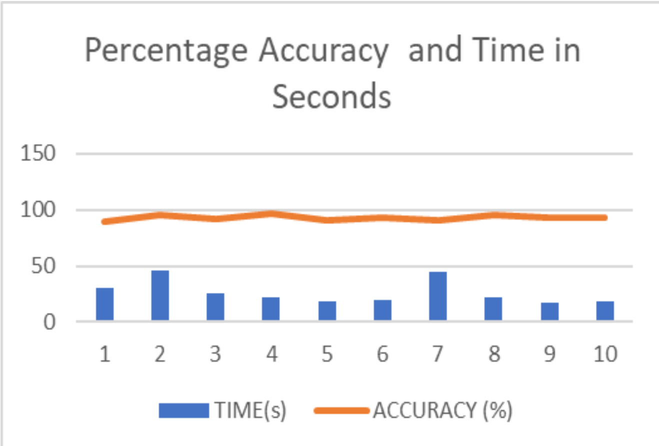
Performance Analysis

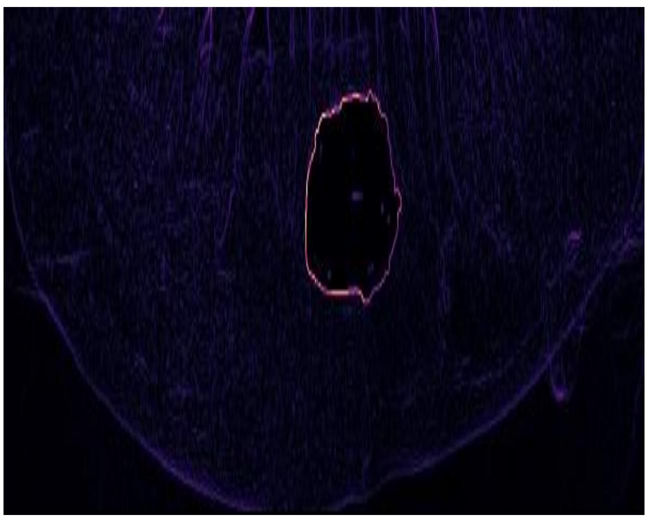
Patient name	actual pixel area	cyst pixel area	Entropy	Contrast		Correlation		Energy		Homogeneity	
				min	max	min	max	min	max	min	max
Image 1	77312	3043	6.793106052	0.2778	0.289	0.936	0.9365	0.1171	0.123	0.876	0.8887
Image 2	80668	13266	6.110503229	0.2076	0.2616	0.9251	0.9404	0.2173	0.2246	0.9051	0.9172
Image 3	80668	15730	5.82492965	0.4386	0.5437	0.9216	0.9365	0.163	0.1672	0.8624	0.8743
Image 4	90450	2802	7.122514518	0.2807	0.3009	0.924	0.93	0.1286	0.1346	0.8704	0.8829
Image 5	89847	3937	6.815555654	0.2261	0.2786	0.9079	0.926	0.1641	0.1711	0.8939	0.9081
Image 6	82611	9591	6.695862805	0.3039	0.4816	0.922	0.9515	0.0969	0.1057	0.8556	0.8811
Image 7	89698	5858	6.692296144	0.2931	0.3085	0.9204	0.9239	0.1503	0.1508	0.8938	0.8939
Image 8	64628	12999	5.932745231	0.4942	0.9516	0.8727	0.9363	0.1538	0.1564	0.8584	0.8757
Image 9	79728	946	7.097867359	0.3198	0.3315	0.9263	0.9288	0.106	0.1112	0.8666	0.8785
Image 10	81270	2280	6.564099951	0.2314	0.3187	0.8947	0.9258	0.1626	0.1635	0.8967	0.904

Table 3. Accuracy achieved and implementation time for ten different OPG images for hysteresis segmentation.

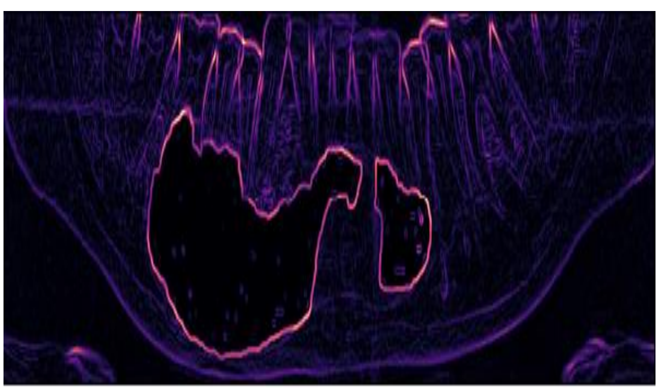
NAME	TIME(s)	ACCURACY (%)
1	30	90.05
2	46	95.08
3	26	92.36
4	22	96.25
5	19	90.22
6	20	92.82
7	45	90.78
8	22	95.53
9	17	92.99
10	18	93.66

Table 2 shows the accuracy achieved for each of the images and the implementation time. The average accuracy attained is 92.9%.





(a)



(b)

Fig. 5 Segmentation of cystic regions using semantic segmentation shown on the panoramic images (a) & (b).

V. CONCLUSION

This paper gives a morphological-based geodesic active contour algorithm for segmentation of cystic regions in panoramic images. This process is advantageous as it is simpler, faster, and does not suffer from instability problems. Figure 3 depicts the percentage of accuracy. Figures 4 and 5 give a clear identification of the cystic regions that are improved in terms of accuracy and the proven the processing time is much lesser than the previous work(20).

This method does not require re-initialization of the embedded function ‘u’ is to the fact that the morphological method is being used. Morphological methods improve their functional gradient descent by improving stability and speed. The hysteresis algorithm exhibits better edge detection performance, a significant reduction in computational time and scalability. A combinational method could be developed for further improvement in accuracy, stability and speed in the future.

Image interpretation of dental X-rays is a difficult task, and the research community pays little attention to it. In addition, a new taxonomy concentrating on imaging modalities-based categorization such as bitewing, periapical, panoramic, CBCT/CT, hybrid datasets and colour photos is also being developed. According to various research papers, the variety of image datasets makes selecting a single segmentation strategy challenging when using standard image processing methods. According to numerous academics cited in this paper, annotated datasets are the key roadblock in the development of a high-performance classification algorithm. Because of the unusual image, dental X-ray imaging data is not the same as other medical images.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

Veena Divya Krishnappa carried out the algorithm implementation and the optimization.

Dr. Anand Jatti has designed the results and simulation of the entire work.

Dr. Vidya M.J has worked on the python programming part of the simulation.

Dr.Revan Kumar Joshi and Dr. Srikar Gade, are involved in the validation of the results obtained to guide and also responsible for writing part of the paper.

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