

Gingivitis detection by Fractional Fourier Entropy and Particle Swarm Optimization

Yan Yan^{1,2*}

¹ School of Informatics, The University of Leicester, University Road, Leicester, LE1 7RH, United Kingdom

² Educational Information Center, Liming Vocational University, Quanzhou, Fujian 362000, China

Abstract

INTRODUCTION: we propose a detection model of gingivitis based on feature extraction based on particle swarm optimization neural network with fractional Fourier entropy.

OBJECTIVES: For the sake of reduce the diagnostic burden of doctors' frequent and high concentration.

METHODS: Primarily, Fourier transform is applied to the collected image signal, and the entropy is extracted from the gingival image by Shannon entropy so as to get the input value. The particle swarm optimization algorithm was combined with the extraction eigenvector is used to detect whether patients have gingivitis in final.

RESULTS: The experimental results show that this method can reduce the unnecessary space of image detection, reduce the complexity of image information, and achieve a sensitivity of $79.00\pm 1.61\%$, specificity of $80.89\pm 1.87\%$ and accuracy of $79.94\pm 0.96\%$.

CONCLUSION: This optimized algorithm can effectively and accurately cluster the sample data, and the accuracy is also higher than the advanced gingival image diagnosis method, making the gingivitis diagnosis more accurate. Our neural network has good trainability and recognition ability, which makes a unique contribution to medically intelligent detection methods for gingival treatment.

Keywords: Multi-layer perception, gingivitis detection, fractional Fourier entropy, particle swarm optimization, detection algorithm.

Received on 04 February 2021, accepted on 24 April 2021, published on 28 April 2021

Copyright © 2021 Yan Yan *et al.*, licensed to EAI. This is an open access article distributed under the terms of the [Creative Commons Attribution license](#), which permits unlimited use, distribution and reproduction in any medium so long as the original work is properly cited.

doi: 10.4108/_____

1. Introduction

Gingivitis is an acute and chronic inflammation of the gingival tissue caused by bacterial infections, foreign irritations and food blockages [1]. The symptoms are mainly red and swollen gums, swelling and pain, and even bleeding [2]. If not treated in time, it may develop to the deep level and lead to periodontitis. Early symptoms of periodontitis are not obvious and may occasionally show bleeding after brushing, similar to the symptoms of gingivitis [3]. However, by the time people find abnormal loosening of teeth, periodontitis has often progressed to the

middle or late stage, and the teeth have gaps and difficult occlusion [4].

Common inflammation of the gums and chronic periodontitis are diagnosed by measuring the depth of the periodontal probe and showing signs of bleeding during the measurement, and using imaging to assess the loss of alveolar bone. However, it is possible for the examiner to obtain different results with different probes, and repeated field measurements may cause great pain to the patient. As a result, generations of several new probes have been invented to boost the accuracy of periodontal probe depth measurements. Moreover, the need for a non-invasive diagnostic approach is made more apparent by the fact that only trained dental specialists can perform the measurements accurately. At present, the number of

*Corresponding author. Email: yy284@leicester.ac.uk

