AN EFFICIENTLY IDENTIFY THE DIABETIC FOOT ULCER BASED ON FOOT ANTHROPOMETRY USING HYPER SPECTRAL IMAGING

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ABSTRACT

Diabetic neuropathies are nerve damaging disorders associated with diabetes mellitus. About 60 to 70 percent of people with diabetes have some form of neuropathy. The nerves damage in foot is develop the ulcer in the foot. An improper maintenance of foot is way of increasing the ulcer. The manual test of patient feet with a hand-held nylon monofilament probe procedure is time consuming, labor intensive, requires special training, is prone to error, repeatability is difficult and it increase the pain. Our goal is automatically detect the pressure point in the pressure area on the foot using this method identify the ulcer via Hyperspectral image processing technique. The proposed system is Efficiently and Automatically identify the diabetic foot ulcer based on foot parameter and provide the accurate result using hyper spectral imaging and foot Anthropometry. The Hyper spectral imaging is used to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes. The human foot is a complex structure, playing an important role in the locomotion processes of the lower extremity. People vary in foot shape, gender, age, race, and even lifestyle habits play an important role in shaping the foot. The foot anthropology is measurement of human individual foot. Advantages of this approach is Easy to identification, efficiently and provide an accurate result the hyper spectral imaging techniques result is much better than other imaging techniques.
Key words: Hyper Spectral Imaging (HSI), Diabetic foot Ulcer (DFU), Diabetic Mellitus (DM), Foot Anthropometry, Medical Hyperspectral Technology (MHT).


1. INTRODUCTION

Diabetes mellitus affects 194 million people worldwide and is expected to increase in prevalence to 439 million by the year 2030[3]. Foot ulceration is a major complication that occurs in as many as 15–25% of type 1 and 2 patients with diabetes mellitus over their lifetime. If left untreated, foot ulcers may become infected and develop deep tissue necrosis, which may require amputation [13]. Diabetic neuropathy is a one of complication of diabetic mellitus. Diabetes can harm our nerves. Diabetic peripheral neuropathy is a common complication of diabetes mellitus, typically around 60% of all Type 2 diabetics will develop this condition within 10 years of being first Diagnosed[2]. Diabetic foot ulceration is a major complication of diabetes and afflicts as many as 15 to 25% of type 1 and 2 diabetes patients during their lifetime. Hyperspectral imaging is a technology that is beginning to occupy an important place in medical research with good prospects in future clinical applications. Hyperspectral imaging (HSI) is an emerging medical technology that offers the possibility of extracting both spectral and spatial information about each pixel from a tissue/organ/body image. Medical HyperSpectral Technology (MHT) provides a novel diagnostic tool that quantifies tissue oxygenation and presents it in an anatomically relevant map[4]. HT has the capability to identify micro vascular abnormalities and tissue oxygenation in the diabetic foot and predict ulcer healing. HT can assist in the management of foot ulceration.[12]. Foot Anthropometry, refers to the measurement of the human individual foot shape. The human foot is a complex structure, playing an important role in the locomotion processes of the lower extremity. It is a part of the body that acts on external surface, providing support and balance during stance and gait. Anthropometric variables such as foot length, joint girth, bottom width, are stochastic variables in geometrical description of the foot[14].

Figure1.1. Identify the ulcer in the foot of diabetic patient
Hitherto the Semmes–Weinstein monofilament examination (SWME) method is one of the most common tests used to identify PSN and increased risk of ulceration, through the examination of five pressure points at specific weight bearing areas, namely the toe (hallux), metatarsal, and heel (Calcaneum). An extruded homopolymer monofilament (SWM) probe is applied by a trained clinician[2]. The SWM is designed to bend by 10 mm (gauged commonly by sight) when 10 g (98 mN) force is applied. Studies have shown that the inability to detect the SWM, when it bends by 10 mm at 10 g force, indicates a degree of neuropathy.

2. LITERATURE SURVEY

HT has the capability to identify micro vascular abnormalities and tissue oxygenation in the diabetic foot and predict ulcer healing. HT can assist in the management of foot ulceration.[12]. Hyperspectral imaging (HSI), also called imaging spectrometer, originated from remote sensing and has been explored for various applications by NASA[11]. This information is very useful in the characterization, identification, and classification of different biological tissues for diagnostic purposes and medical treatment monitoring. Anthropometric variables such as foot length, joint girth, bottom width, are stochastic variables in geometrical description of the foot[14] with the purpose of finding objects, identifying materials, or detecting processes. The human foot is a complex structure, playing an important role in the locomotion processes of the lower extremity. People vary in foot shape, gender, age, race, and even lifestyle habits play an important role in shaping the foot. The foot anthropometry is measurement of human individual foot. Advantage of this approach is Easy to identification, Efficiently and provide an accurate result the hyperspectral imaging techniques result is much better than other imaging techniques.

This paper presents the first investigation of a novel approach to automatically identify the pressure points on a given patient’s foot for the examination of sensory neuropathy via optical image processing incorporating plantar anthropometry[1]. The goal of hyperspectral imaging is to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes.

3. METHODOLOGY

3.1. EXISTING METHOD

MHSI can be limited because it examines only areas of tissue near the surface. MHSI can also be limited by the cost of HSI imaging systems and by the ability to extract relevant information from large datasets[11]. There are no accurate method of determining the axis of the talocalcaneal joint in the living subject has emerged from this study. The filament with tips devices are not commercially available. However, the problems with tip anatomy are just the tip of the problem. In the force generation The baseline threshold is therefore higher than reported, potentially masking subtle effects due to treatment and thus leading to false negative results. In the Experimenter bias the application inaccuracies and irregular force production issues discussed above would tend to decrease rather than increase test sensitivity. However, it is also possible that the efforts to blind the tester tipped the balance to negative rather than positive results. The ideal stimulator device is not commercially available[10].

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3.2. PROPOSED METHOD

The proposed system is efficiently and automatically identify the diabetic foot ulcer based on foot parameter and provide the accurate result using hyper spectral imaging and foot anthropometry. The hyper spectral imaging is used to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes. The human foot is a complex structure, playing an important role in the locomotion processes of the lower extremity. People vary in foot shape, gender, age, race, and even lifestyle habits play an important role in shaping the foot. The foot anthropometry is measurement of human individual foot. Advantage of this approach is easy to identification, efficiently and provide an accurate result the hyperspectral imaging technique results much better than other imaging techniques.

This paper presents the first investigation of a novel approach to automatically identify the pressure points on a given patient’s foot for the examination of sensory neuropathy via optical image processing incorporating plantar anthropometry[1]. The method automatically selects suitable test points on the plantar surface that correspond to those repeatedly chosen by a trained podiatrist. The system automatically identifies the specific pressure points at different locations, namely the toe (hallux), metatarsal heads and heel (Calcaneum) areas[1]. The proposed system presents the collecting all information study and review of diabetic neuropathy foot parameters process the data’s using hyper spectral imaging technique and foot anthropometry.

Hyperspectral imaging, like other spectral imaging, collects and processes information from across the electromagnetic spectrum. The goal of hyperspectral imaging is to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes. HT measurements of oxyhemoglobin (HT-Oxy), deoxyhemoglobin (HT Deoxy) were performed at or near the ulcer area, and on the upper extremity and the lower extremity distant from the ulcer.

![Flow Diagram Ulcer For Proposed Method](image)

*Figure 3.2.1 Flow Diagram Ulcer For Proposed Method*
Shape analysis became easy in case of binary images. Pixel Locations describe the shape. Digital Morphology is a way to describe or analyze the shape of a digital image. Erosion is one of the two basic operators in the area of mathematical morphology, the other being dilation. It is typically applied to binary images, but there are versions that work on grayscale images. Foot Anthropometry, (from Greek anthropos, "human", and Merton, "measure") refers to the measurement of the human individual foot shape. Anthropometric variables such as foot length, joint girth, bottom width, are stochastic variables in geometrical description of the foot [14].

The foot anthropometry is measurement of human individual foot. Multivariate analysis between foot dimensions reveal how to precisely improve footwear fit and comfort[8]. This approach used for both Caucasian and nonflat feet diabetic patient. The hyperspectral imaging for both V and U shaped foot

4. IMPLEMENTATION
The Hyper spectral imaging is used to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes. Hyperspectral imaging can allow the physician to identify diabetic feet at risk of developing ulcer(s) and to predict if existing foot ulcers will heal, all during an initial screening instead of making multiple observations over several months.
HT has the capability to identify micro vascular abnormalities and tissue oxygenation in the diabetic foot and predict ulcer healing. HT can assist in the management of foot ulceration[4]. The hyperspectral imaging techniques result is much better than other imaging techniques.

The manual test of patient feet with a hand-held nylon monofilament probe procedure is time consuming, labor intensive, requires special training, is prone to error, repeatability is difficult and it increase the pain. In this approach a scanner is used to obtain the patients plantar surface image Then via developed image processing, and now working on its generalization, the orientations of pressure points are identified. Our method is automatically detect the pressure point in the pressure area on the foot and identify the ulcer via Hyperspectral image processing technique .The proposed system is Efficiently and Automatically identify the diabetic foot ulcer based on foot parameter and provide the accurate result using hyper spectral imaging and foot Anthropometry.
5. CONCLUSION AND FUTURE WORKS

5.1. CONCLUSION
The manual test of patient feet with a hand-held nylon monofilament probe procedure is time consuming, labor intensive, requires special training, is prone to error, repeatability is difficult and it increase the pain. In this approach a scanner is used to obtain the patients plantar surface image Then via developed image processing, and now working on its generalization, the orientations of pressure points are identified. Our method is automatically detect the pressure point in the pressure area on the foot and identify the ulcer via Hyperspectral image processing technique. The proposed system is Efficiently and Automatically identify the diabetic foot ulcer based on foot parameter and provide the accurate result using hyper spectral imaging and foot Anthropometry. Using this approach identification the ulcer easily, Efficiently and provide an accurate result.

FUTURE WORK
Hyperspectral imaging has some limitations including the need to know the chromophores and structure of the tissue prior to image analysis In future try to use the HDR imaging technique for identify the ulcer more efficiently.

REFERENCES


[7] R. E. Isman V. T. Inman, M .D, Anthropometric Studies of The Human Foot and Ankle, Biomechanics Laboratory University of California San Francisco Medical Center 1964
An Efficiently Identify The Diabetic Foot Ulcer Based On Foot Anthropometry Using Hyper Spectral Imaging


[13] A.Suresh1, S. Lavanya, Analysis of Segmentation Techniques on Foot Ulcer Images, IJARSE,,.3, Special Issue (01), September 2014


[15] Bonnie Yuk San Tsung Ming Zhang, PhD; Yu Bo Fan, PhD; David Alan Boone, Quantitative comparison of plantar foot shapes under different weight-bearing conditions, Journal of Rehabilitation Research and Development 40(6), November/December 2003 Pages 517–526

[16] N. Hex, C. Bartlett, D. Wright, M. Taylor and D. Varley, Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs, York Health Economics Consortium Ltd, University of York, York, UK Accepted 25 April 2012


M. Bharara, MSc, J. E. Cobb, PhD, CEng, and D. J. Claremont, Thermography and Thermometry in the Assessment of Diabetic Neuropathic Foot: A Case for Furthering the Role of Thermal Techniques, DOI: 10.1177/1534734606293481 © 2006 Sage Publications

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