Automatic Extraction of Features in Thermographic Images

Maria L. C. Ferreira, Laura A. Varela, Caroline D. Vilar Wanderley and Heliana B. Soares

Abstract— **In this article, an automatic computational method was proposed for the extraction of characteristics from thermographic images of people who practice physical activities, through digital image processing techniques, with the objective of helping the physical educator to monitor the athlete's physical performance. In the testing phase of the algorithm, satisfactory results were obtained indicating the areas most worked during training.**

I. Introduction

Thermography is the procedure for capturing images of bodies where the temperature is greater than absolute zero. Infrared cameras, or thermal imagers, convert the thermal radiation emitted by human skin into images, in which it is possible to observe the mapping of the surface temperature of this body. [1].

Alterations are identified on a thermogram in cases of disease and functional and structural changes, showing areas of hyporadiation, hyperradiation or right-left contralateral thermal difference above 0.3°C [2]. Several authors show that thermography is already being used in the medical field, with the association of body temperature and indication of possible dysfunctions, as well as in sports medicine, in the identification of risks for athletes, prevention and location of injuries and in the choice of intensity of training. In order to assist professionals and help identify injuries during physical activities, this article aims to implement an algorithmic strategy for automatic extraction of characteristics from the thermographic images of athletes before and after training.

II. Materials and Methods

The work methodology is illustrated through the block diagram (Figure 1) with the strategies used to extract the significant characteristics of thermographic images.
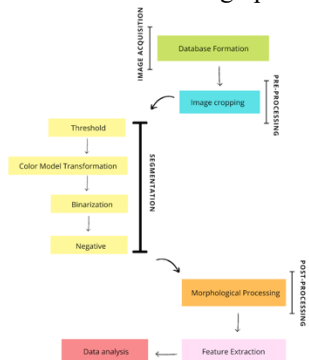

Figure 1.   Block diagram of the proposed algorithm.

All the authors are with the Federal University of Rio Grande do Norte, Caixa Postal 1524, Campus Universitario Lagoa Nova, Natal/RN, CEP: 59.078-970, Brazil (corresponding author to provide phone: +55-84-99986-4066; e-mail: helianabs@gmail.com).

The algorithmic strategy proposed in this study can help professionals in the area, enabling better monitoring for athletes, individuals with some limitation and/or difficulties in performing exercises, or those who present pain characteristic of inflammation or muscle injuries, in order to get more information about each individualized case efficiently and quickly, using thermography (Figure 2).

Due to the COVID-19 pandemic scenario, all simulated data and the 28 database images presented in this work were from a female athlete, 23 years old, healthy and with no history of disease. The training took place in the condominium where he lives, with the presence of his physical educator.
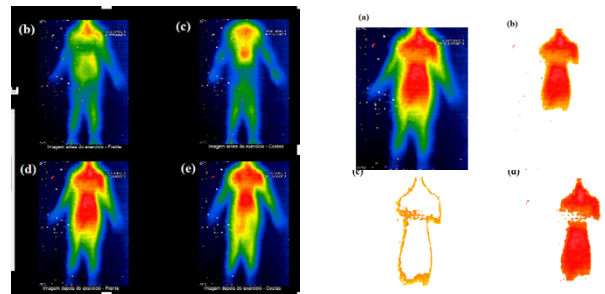

Figure 2.   Images resulting from applied processing.

III. Conclusions

Using the developed tactic, thermograms can be quickly analyzed before and after any sport practice. With the data extracted, it is possible for the professional in the area to indicate which is the best option for your patient, automatically through the developed system and visual analysis of your results, helping to confirm a diagnosis. The thermal images and the proposed analysis of the study can serve as an aid for the physical education professional to adjust the level of training intensity so as not to aggravate the case at that time, know when to perform before the race, a strengthening in the area so that there is no more discomfort and pain, as well as knowing the situation and evolution of the affected region.

References

[1] SILVA, S.V. Reconstrução da Geometria da Mama a partir de Imagens Termográficas. Tese de Doutorado – Curso de Pós-Graduação em Computação, UFF, Niterói, 2010.

[2] BRIOSCHI, M.L.; LIN, T.Y.; TEIXEIRA, M.J. Indicações da termografia infravermelha no estudo da dor. Rev. DOR é coisa séria - VOL. 5 - Nº 1 - JANEIRO/2009.