I/UCRC FAU CAKE Executive Summary - Project Synopsis		**Date**: July 14, 2016
Project Title: Medical image analysis using deep learning techniques	**Phone:** (561) 297-3180	**E-mail: bfurht@fau.edu** and **omarques@fau.edu**
Center/Site Director: Borko Furht, PhD		**Type: (New or Continuing)**: New
Project Leader: Oge Marques, PhD - (561) 297-3857		**Proposed Budget**: $60,000
Project Description: There are many relevant open problems in medical imaging for which the human expert (physician, radiologist) could benefit from intelligent tools, implemented using the latest trend in artificial intelligence: deep learning methods. This project focuses on two types of problems within this domain: (i) (semi-) automatic image **segmentation** and (ii) image **annotation** and **retrieval**. In this first year, the focus will be on visible spectrum *macroscopic pigmented skin lesion* (MPSL) images such as the ones collected regularly in dermatologist's offices, but the developed methods should be extensible to similar tasks in other domains with their associated datasets. Our overall goal is to develop a solution for processing photographs of skin lesions that performs: (i) (semi-) automatic image **segmentation**, outlining the contours of the lesion; (ii) automatic **annotation** of the image; and (iii) **retrieval** of similar images and/or medical cases.		
Experimental plan: (1) Research deep learning frameworks and methods. (2) Build training and testing datasets. (3) Research, implement, and test image segmentation solutions. (4) Develop *proof-of-concept solution* for skin lesion segmentation. (3) Research, implement, and test image annotation and retrieval solutions. (4) Develop *proof-of-concept solution* for skin lesion annotation and retrieval.		
Related work elsewhere: Deep learning in medical image analysis is an extremely hot contemporary research topic. We will thoroughly explore the literature related to this field of research.		
How this project is different: This project leverages our team's experience and published work with (patent-pending) innovative techniques for skin lesion segmentation and measurement, as well as medical case retrieval (MCR).		
Milestones for the current proposed year: (1) Build a meaningful dataset of skin lesion images. (2) Design and implement novel medical image segmentation algorithms and compare them with existing ones. (3) Design and implement novel medical image annotation and retrieval algorithms and compare them with existing ones		
Deliverables for the current proposed year: Source code for a *proof-of-concept solution* consisting of algorithms for segmentation, annotation, and retrieval of images containing skin lesions.		
How the project may be transformative and/or benefit society: Skin cancer is a growing health concern: 2-3 million non-melanoma skin cancers and 132,000 melanoma skin cancers occur globally each year, one in every three cancers diagnosed is a skin cancer, and one in every five Americans will develop skin cancer in their lifetime. Melanoma is a deadly form of skin cancer, but survival rates are high if detected and diagnosed early. There is a growing need for automated systems capable of assessing a patient's health using photographs of their skin lesions, as proposed.		
Research areas of expertise needed for project success: Experience in image processing – particularly color image segmentation – and machine learning techniques, particularly deep learning frameworks.		
Potential Member Company Benefits: CAKE member company should be able to add value to apps in the fast-growing and lucrative domain of medical imaging.		
Progress to Date: Initial research and feasibility analysis of the proposed project have been already conducted. Simple proof-of-concept solutions (implemented in MATLAB and tested on a small set of image samples) have been developed.		
Estimated Start Date: 8/31/2016	**Estimated End Date**:8/30/2017	

The Executive Summary is used by corporate stakeholders in evaluating the value of their leveraged investment in the center and its projects. It also enables stakeholders to discuss and decide on the projects that provide value to their respective organizations. **Ideally, the tool is completed and shared in advance of IAB meetings to help enable rational decision making.**