RADICAL UNIVERSITY ARRANGEMENTS TO CREATE ENTREPRENEURIAL UNIVERSITY

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Abstract

In this paper we present non-traditional, radical university arrangements that we implemented in the College of Engineering and Computer Science at FAU in order to create an Entrepreneurial University. In order to produce successful engineers our thesis is that they should be involved in the applied industry projects. In the present state of the economy, research funding has been drastically reduced – these are chances for universities. However, universities can only effectively become incubators of entrepreneurship and innovation if they themselves practice entrepreneurship. This “re-conceptualization” involves non-traditional, often radical university arrangements. The backbone of our new concept is the NSF-sponsored Industry/University Cooperative Research Center for Advanced Knowledge Enablement with 36 industry members, a more than 40 applied research projects. The university has created Research Park at university premises with more than 30 high-tech companies and an incubator with 27 start-up companies. As part of our strategy, based on our research, we launched two start-up companies that are led by our faculty and students. We also created joined industry/university laboratories, in which our faculty and students work jointly with industry scientists and engineers in creating innovative systems and products.

Keywords: entrepreneurial university, industry/university cooperative research center, applied industry projects

1 INTRODUCTION

What is an entrepreneurial university, and how does it address the world’s biggest problems? For different people the term “entrepreneurial university” has different meaning ([1], [2]). Here are a few characteristics that we believe define an entrepreneurial university:

- An entrepreneurial university encourages partnerships between academics, and entrepreneurs with the objective to produce results, which will have impact and resolve some important problems.
- An entrepreneurial university values both innovation and execution. With the demise of the great corporate research labs and the limitations of the growth of government research institutes, research universities are becoming primary sources of societal innovations. ([1], [2], [3]).
- An entrepreneurial university encourages multidisciplinary teams that leverage the unique strengths of the entire institution.
- An entrepreneurial university connects the academic world with the outside world, because complex problems cannot be solved without interaction with the environments in which they occur.

Another definition, found in [3], refers to “Entrepreneurship University as an exciting concept which defines those universities providing opportunities, practices, cultures, and environments to actively encouraging and embracing student and graduate entrepreneurship.” In the same article, Gibb proposes three alternative organization models for the Entrepreneurial University: (i) The optimum fully integrated model, (ii) The Intermediate: university-led model, and (iii) The external support model: stakeholder driven. In this paper, we present our strategy that we implemented in the Department of Computer & Electrical Engineering and Computer Science in creating an entrepreneurial university. We can summarize our strategy through the following steps that we implemented in the last four years:

1. We established NSF-funded Industry/University Cooperative Research Center for Advanced Knowledge Enablement (jointly with Florida International University of Miami).
2. We established collaboration with high-tech companies in the FAU Research Park
3 We initiated a number of applied research projects with industries in South Florida
4 We created industry/university laboratories in our College
5 We worked with FAU Tech Runway and College of Business professors and students in commercializing our research and launching start-up companies.

We discuss all these activities in the paper. We also present a case study of a successful project and several phases of commercialization.

2 METHODOLOGY

In 2009, Florida Atlantic University received a five-year grant from the National Science Foundation (NSF) to create the site of the Center for Advanced Knowledge Enablement (CAKE) as an Industry/University Cooperative Research Center (I/UCRC) that will provide a framework for interaction between university faculty and students and industry in the critically important areas of information technology, communication, and computing.

During the last ten years, the NSF I/UCRC has proven to be a win-win situation both for our university and our industry and government partners. We have been conducting industrially relevant research, receiving additional funding for it, and benefiting from the recognition and prestige of being an NSF Research Center. The Center is successfully building the bridge linking academia, industry, and government in a coordinated research initiative, which this region desperately needs. The Center has 36 industry members with the total memberships of $5 million in CAKE membership, 4 million in equipment and software membership, and about $3 million in NSF funding. We have had 36 active industry projects with 18 faculty and more than 50 graduate and undergraduate students involved in these projects. The Center’s mission is to accomplish the following goals:

- To continuously evolve an understanding of the technology needs of the industry sector through direct contact with industry professionals and related corporations.
- To identify applied research themes that meet the needs of private and public sectors.
- To conduct industry-relevant research.

Our Center research agenda includes the creation of new technologies for various Web-based applications, next generation of hardware and software development techniques and tools, mobile and wireless systems and technologies, video compression and communication technologies and systems, networking and communication systems, data mining and machine learning technologies, and various interdisciplinary initiatives and applications including medical systems and healthcare informatics.

Figure 1 presents our research focus, which includes the following research areas: big data analytics, multimedia and data mining, video and image processing, and cloud computing, sensors, and networks. Vertical applications include medical and healthcare, environmental, and mobile, traffic, and industrial applications.

The organization of the Center is shown in Figure 2. Memberships are open to private businesses, government agencies, and others with research needs in the areas of information technology, communications, and computing. The Center provides its partners with numerous benefits, including early access to research innovations and opportunities to interact and work with university faculty, students, and industry peers.
The Center is housed in the new LED-certified platinum green Engineering building (Figure 3a), which is powered with the state-of-the-art private cloud computing system (Figure 3b). There are total 9 research laboratories and 6 instructional laboratories, which are available for faculty, students, and industry researchers, who are involved in the Center’s projects.
The Center’s Industry Advisory Board (IAB), made up of representatives of all members, has the responsibility of determining the research areas and related projects in which membership fees will be invested. The IAB meets twice a year to discuss proposed projects and set research priorities for the Center. The IAB makes recommendations on research projects to be carried out by the Center and the allocation of resources to these projects. Companies paying higher membership fees have priority in selecting the Center’s research projects. Here is a list of several recent projects completed in the Center [4, 5]:

- Modelling Ebola spread using big data analytics
- Developing machine learning algorithms on HPCC/ECL platform
- Driver drowsiness detection system
- Medical image analysis using deep learning techniques
- Smart building optimization systems and algorithms
- Applications of common machine learning algorithms in auto industry

Our members include large companies including LexisNexis, JM Enterprises, Motorola Mobility powered by Google, Tecore Networks, Emerson, Tellus, as well small and start-up companies including ARC Devices, Mobilehelp, Soren Technology, Vlatacom, and others. For detailed information refer to the Center’s Website at http://cake.fau.edu.

3 CASE STUDY

In this section we describe our latest project in designing and commercializing cloud-based skin diagnosis system using convolutional neural networks. The technical part of the project has been initiated in the NSF I/UCRC Center; software algorithm for melanoma detection has been developed (Figure 4), and several research papers were published. Our technical team was frustrated that this brilliant research just sits on the lab shelves rather than creating jobs or meeting patient needs.

And then, thanking to the launching of the FAU Tech Runway [6], we found the solution by creating 10-person interdisciplinary project team consisting of group of faculty and students from engineering and business, and successful business mentors, who are part of the FAU Tech Runway. (Figure 5).

Figure 4. Flow-chart: an automated solution for processing lesions images for melanoma detection.
Our objective has been that through the key aspects of product engineering design, business planning, patent filings, and marketing strategy for melanoma detection system, we either license the system to a corporate partner for further development, or launch as a start-up company. We wrote a proposal to Farris Foundation in Palm Beach and received two-year funding for this project.

As part of the project in the first year we developed the complete cloud-based system [7], shown in Figure 6, and business and marketing plans.

The system consists of the client device, cloud database, and server that is connected to both cloud database and the script that loads the CNN, as shown in Figure 6. Any device that has internet connection could connect to the cloud database and upload lesion images to be processed. At the end of the diagnosis process, a skin lesion classification and the confidence score computed by the CNN is reported back to the client. Once an image is uploaded from a device to the cloud database, the CNN server is notified which then downloads the image and informs the CNN script to process the image with the already trained CNN. Once a result is acquired from the CNN, such as melanoma or benign lesion, the result is sent back to the CNN server which updates the cloud database which then updates the client with the lesion results.

We developed an application for both Android and iOS platforms in order to complete the entire cloud-based skin lesion diagnosis system. The application connects to Firebase at startup to upload images and receive results from the diagnosis pipeline. The application is a hybrid mobile app built using Ionic SDK. With Ionic, developers can build mobile and web applications using Web technologies like
HTML, CSS, and Javascript with built-in native features that the device offers like camera and geolocation. Using the same source code, the application can be compiled to run on multiple platforms devices which includes Android, iOS, and web browsers.

The application connects to the device’s camera and displays the camera stream. The user is guided with a red circle to help place the skin lesion centered horizontally and vertically in the visual field of the camera (Figure 7). This is an important feature because the lesion images in the dataset are centered on the lesion and replicating this property in the user requests may increase the accuracy of the diagnosis. Once an image is taken by the user, the users have the option to either retake the image or upload the image to Firebase. Before uploading, the image is cropped and resized to match the exact dimensions of the diagnosis and preliminary CNNs. Once uploaded, the user is taken to the History page, which displays results from the diagnosis CNN, as illustrated in Figure 8.

During the diagnosis process, the uploaded request is marked as ‘processing’. Once a result is acquired, the app is updated with a diagnosis and confidence score of the diagnosis CNN. If an image does not pass the preliminary CNN, the user is notified with a warning text.

The diagnosis system being cloud-based, complexity of the application is minimal. The main requirements of the application are connection to the camera and Firebase and client-side image resizing which can be done with few lines of Javascript. The minimalist nature of the front-end application also allowed for a very quick design and implementation.

We also participated in submitting i-Corps NSF proposal, which was awarded to FAU in 2019. NSF I-Corps program prepared us to extend our focus beyond the university laboratory and accelerates the economic and benefits of NSF0funded, basic research projects that are ready to move toward commercialization [8]. Through I-Corps award we learned to identify valuable product opportunities that emerged from our academic research, we established a start-up companies DermaGo/Farris, and we gained skills in entrepreneurship through training in customer discovery and guidance from mentors who are established entrepreneurs.

*Figure 7. The application utilizes the native camera on the mobile phone to takes pictures of lesions.*
In summary, Figure 9 illustrates the three-phase process that we applied: starting with research in data analytics techniques for melanoma detection, to creating interdisciplinary teams with business researchers and entrepreneurship mentors, and to launching a start-up company for the commercialization of our research.

4 CONCLUSIONS

In summary, research universities are increasingly critical hubs in the ecosystem of global innovation. Broad commercialization of scientific discoveries and technology breakthroughs is a rising priority of many research universities including ours. We believe that licensing of new products and services to existing companies or to university-affiliated start-up companies is an important potential source of new revenue, but it is also evaluated in the context of the university’s broader role in the local and global innovation ecosystem.

In this paper, we presented our approach in creating an entrepreneurship university with the main focus on working closely with high-technology companies through the NSF-funded Industry/University Cooperative Research Center. We believe that we were able to build an innovative infrastructure which provides us to better connect with the needs of industry and society. After graduation, a number of our undergraduate and graduate students were hired by these industries. We also presented a case study of commercialization of our own research by establishing interdisciplinary teams with business faculty and students as well as with business mentors.
ACKNOWLEDGEMENTS

This work has been funded by the NSF Award No. 934339, Industry/University Cooperative Research Center, Phase II. We also acknowledge Farris Foundation, which funded the project for the commercialization of our research, and 36 industry partners and their researchers, as well as more than 100 FAU students involved in various Center's projects.

REFERENCES


