



PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Chiara Caputi

XXXIV Cycle

Training and Research Activities Report – First Year

Tutor: Prof. Leopoldo Angrisani



1. Information

My name is Chiara Caputi, I hold my master's degree in Electronic Engineering at University of Naples "Federico II" in 04/10/2018 with the thesis "*LoRa technology for communication between devices on the medium voltage network*". I'm a Ph.D. fellow (XXXIV cycle) in Information Technology and Electrical Engineering (ITEE). My fellowship is without scholarship and my tutor is Prof. Leopoldo Angrisani.

2. Study and Training activities

List of attended courses and seminars:

a. Modules

- Big Data
- Data Science and optimization
- Author seminar: How to publish a scientific paper

b. Seminars

- Matlab and embedded system
- Computational and machine learning methods for complex ecosystem
- Workshop at STMicroelectronics on STM32WB
- Workshop at STMicroelectronics on "Wireless communication and sensors"
- Workshop at STMicroelectronics on "Microcontrollers and artificial intelligence"
- Microcontrollori a 32 bit: connessi e sicuri - NeaPolis Innovation Technology Day 2018
- The Evolution of Power Conversion - NeaPolis Innovation Technology Day 2018
- Managed Memory System - NeaPolis Innovation Technology Day 2018
- Dalla Tecnologia all'applicazione in Cloud con strumenti alla portata di tutti - NeaPolis Innovation Technology Day 2018
- Il 5G e l'evoluzione delle reti radiomobili
- An introduction to Blockchain
- Selected Application of Semiconductor emitters in medicine

c. Ph.D. School

Has attended the 2019 Instrumentation & Measurement PhD School "Italo Gorini" and has successfully passed the final examination with merit.

d. Course

Misure Meccaniche e Termiche

	Credits year 1							Summary
	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	
Modules	20	9,4	1,2	3	0	0	4	18
Seminars	5	2,4	0,5	3,4	0	0	0	6,3
Research	35	7	8	8	7	8	8	46
	60	19	9,7	14	7	8	12	70

3. Research activity

My research activities were focused on the “Enabling technologies for continuous monitoring of well-being and healthiness in the agri-food chain”; during this year two main topics were developed:

- Machine learning applied at electric conductivity for Smart agriculture;
- Innovative communication method with LoRa technologies for a measurement platform in Smart agriculture.

The quality and healthiness of the environments in which primary production originates and in which the subsequent transformation processes were carried out, influence food safety, the sustainability of production processes and condition the economy of the agri-food and livestock sector and, not least, the consumer health. To this aim, in cooperation with the Department of Veterinary University of Naples Federico II, a relevant problem in the milk production chain was analysed and studied i.e. mastitic milk due to the mastitis pathology.

The mastitic milk was characterized by a high number of somatic cells (SCC) and changes in the composition, which results, in productive terms, in a reduction of the coagulation capacity, loss of yield of the cheese, associated with the production of a cheese of poor quality and high moisture content [1,2]. Furthermore, the presence of bacteria and other infectious agents that could be dangerous for humans and contaminate food safety and quality should not be forgotten [3]. So, the early identification of the pathology therefore assumes considerable importance [4].

My research activity in this compound was focused on finding a strictly correlation with the somatic cells and electric conductivity of milk with statistic methods and then thanks to the preliminary positive results obtained, a realization of a predictive system for the identification of the mastitic pathology with machine learning algorithms [5]. The input data (conductivity) was collected in milking room and a research correlation also with temperature was started including thermal images.

The second research activity was oriented to the final project which has as its objective the development of technological platforms able to provide the consumer with information on the production and the intrinsic quality of the product and therefore both on the welfare of the animals and on the relationship between functional and non-functional product molecules. For this task the starting point was the communication of sensors; so, aimed to use an innovative protocol [6], thanks to the acquired knowledge in master's thesis in LoRa communications, the work was continued with the aim to test and study this technology for the feasibility of application in smart agriculture.

[1] - Munro G.L., P.A. Grieve and B.J. Kitchen. (1984). Effects of mastitis on milk yield, milk composition, processing properties and yield and quality of milk products. *Aust. J. Dairy Technol.* 39:7-16.

[2] - Grandison A.S. and G.D. Ford. (1986). Effects of variations in somatic cell count on the renner coagulation properties of milk and on the yield, composition and quality of Cheddar cheese. *J. Dairy Res.* 53:645-655.

[3] - Politis I. and K.F. Ng-Kwai-Hang. (1998). Association between somatic cell count of milk and cheese yielding capacity. - *J. Dairy Sci.* 71:1720-1727.

[4] - Sharma N., V. Pandey and N.A. Sudhan. (2010). Comparison of some indirect screening tests for detection of subclinical mastitis in dairy cows. *Bulg. J. Vet. Med.* 2:89-103.

[5] - Esmaeil Ebrahimie, Faezeh Ebrahimi, Mansour Ebrahimi, Sarah Tomlinson, Kiro R. Petrovski, Hierarchical pattern recognition in milking parameters predicts mastitis prevalence, *Computers and Electronics in Agriculture* Volume 147, April 2018, Pages 6-11.

[6] - Bonavolonta F., Caputi C., Liccardo A., Teotino A., “Protection of MV smart grid based on IoT technology” 2019 *MetroInd4.0&IoT IEEEExplore*.

Collaboration:

Department of Veterinary University of Naples, Federico II

4. Products

a. Publications

- i. Bonavolonta F., Caputi C., Liccardo A., Teotino A., “Protection of MV smart grid based on IoT technology” 2019 MetroInd4.0&IoT IEEEExplore

5. Conferences and Seminars

a. Metrology for Industry 4.0 and IoT, Naples 2019

“Protection of MV smart grid based on IoT technology” was presented and demonstration session was attended (speaker).

“Best Live Demonstration” awards.

b. Metrology for Aerospace, Torino 2019.

6. Activity abroad

7. Tutorship

Assistant supervisor for the master’s degree theses listed below:

- a. Mirco Longobardi, Department of Electrical Engineering and Information Technology, “Ottimizzazione e caratterizzazione di un sistema di protezione delle reti MV basato su tecnologia LoRa”
- b. Fortunato Scafarto, Department of Electrical Engineering and Information Technology, “Ottimizzazione di un test-bed per la selettività logica”