



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

itee_{PhD}
information technology
electrical engineering



Sarah Adamo

**Implementation of AI solutions for
medicine and telemedicine**

Tutor: Prof. Mario Cesarelli

Cycle: XXXVII

Year: Second

My background

- MSc Degree in Biomedical Engineering @ DIETI – Federico II
 - *Thesis: “Machine Learning to predict rehabilitative outcomes in post-stroke patients”*
- Ph.D. Fellowship founded by Consortium GARR
 - *Starting date: 01/11/2021 (Ended in March 2023)*
 - *Host Institution: IRCCS Maugeri, Telese Terme (BN)*
- Research group:
 - UNINA Bioengineering Research Group;
 - Maugeri Bioengineering Unit.

Research field of interest

Telemedicine and medical remote assistance:



Patients with chronic disease are more exposed to acute events and require constant monitoring



Telemedicine can be crucial since patients can be assisted from their own home



An effective way to collect huge amount of data...



...used as input for Machine Learning algorithms



Research activity: Problem



Which are the main parameters able to...

- Predict an acute event?
- Identify different phenotypes?

Starting from previous results, ML models were:

- assessed and tested on similar cases;
- implemented on new diseases cases.

CASE STUDIES

Prediction of mortality in
COVID-19 patients



IRCCS Maugeri Telese Terme (BN)


Characterization of acute asthma phenotypes
and prediction of exacerbations

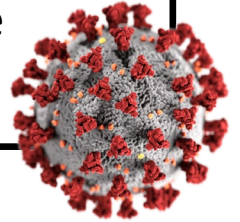


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Research activity: Case study

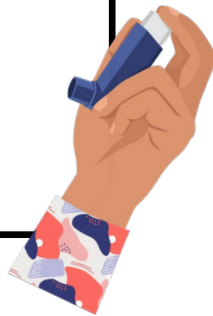
? Prediction of mortality in COVID-19 patients depending on COVID-19 variants (i.e., **wild type, alpha, gamma, delta, omicron**).

 Identification of the main clinical parameters that highly influenced the outcome per each variant; comparison of them among the variants.



? Clustering for the identification of different clinical phenotypes of asthmatic patients. Basing on the results, setting of a threshold for the classification (eosinophil count).

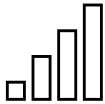
 Prediction of future exacerbations of severe and acute asthma events and identification of the most important clinical parameters



Research activity: Methodology



Data acquisition and processing



Feature selection



- Unsupervised ML (clustering, silhouette coefficient);
- Supervised ML (classification, 2 or more classes)



Feature Importance



Validation of results (hold-out, cross-validation)



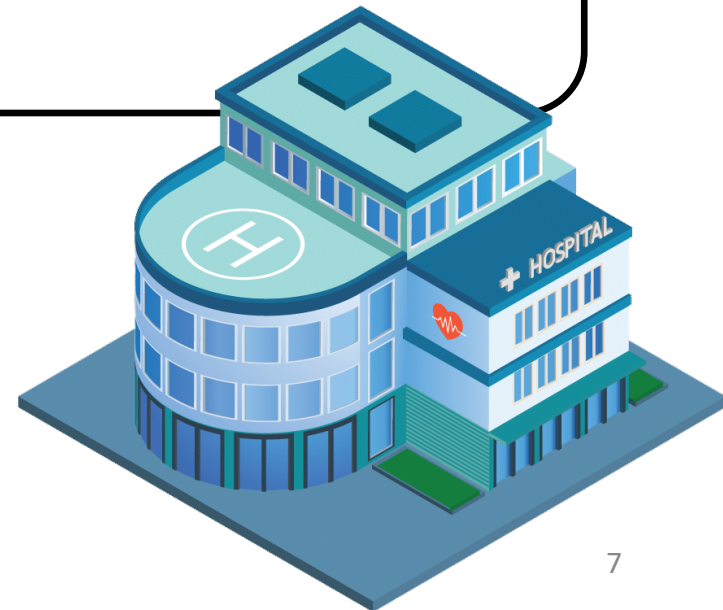
Application of the results to real approaches

Research activity: Problem 2



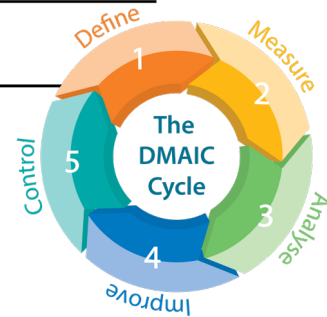
A managerial approach to investigate falls risk in a rehabilitation hospital

1. Analyze the fall-related anamnestic and clinical data
2. Distinguish fallers/recurrent fallers and estimate the consequences of falls



Research activity: Methodology

Project title	
A managerial approach to investigate fall risk in a rehabilitation hospital	
Problem Statement	Objective Statement
Excessive number of falls in a rehabilitation hospital	Introduce clinical measures that can solve and reduce the presented problem
Critical to quality	Target
<ul style="list-style-type: none"> Clinical effect and consequential interventions due to falls Fall recurrences 	Analyze the rehabilitative hospital context in relation to falls and eventually realize corrective measures
Timeline	
Define → January 2022 – April 2022	
Measure → May 2022 – August 2022	
Analyze → September 2022 – December 2022	
In scope	Out of Scope
<ul style="list-style-type: none"> Falls Scientific Clinical Institute Maugeri, Bari, Italy 	<ul style="list-style-type: none"> All the other clinical accidents All the other structures
Business need	
Reducing falls and their impact on Public Health	



Research activity: Objective



Implementation of AI solutions



Prediction of clinical outcomes



Supporting clinical decision making



More improvements
Less healthcare management costs



Essential Assistance Levels (LEA) in non-urbanized area



Better Quality of Life for all patients

Summary of study activities

- Ad hoc PhD courses:
 - Using Deep Learning Properly
- Research and study on machine learning in medicine and telemedicine (particularly focusing on COVID-19 and Health Management Systems)

Products

[P1]	Cesarelli, G., Petrelli, R., Adamo, S., Monce, O., Ricciardi, C., Cristallo, E., ... & Cesarelli, M. (2023). <i>A Managerial Approach to Investigate Fall Risk in a Rehabilitation Hospital</i> . <i>Applied Sciences</i> , 13(13), 7847.
[P2]	Amboni, M., Ricciardi, C., Adamo, S., Nicolai, E., Volzone, A., Erro, R., ... & Barone, P. (2022). <i>Machine learning can predict mild cognitive impairment in Parkinson's disease</i> . <i>Frontiers in Neurology</i> , 13, 1010147.

Thanks for the attention!

