DESIREE - a web-based software ecosystem for the personalized, collaborative and multidisciplinary management of primary breast cancer

Nekane Larburu[1,2], Naiara Muro[1,2,3], Mónica Arrue[1,2], Roberto Álvarez[1,2], Jon Kerexeta[1,2]
[1]eHealth and Biomedical Applications, Vicomtech, Donostia-San Sebastian, Spain
[2]Biodonostia, Donostia-San Sebastian, Spain
[3]Sorbonne Universités, UPMC Univ Paris 06, INSERM, Université Paris 13, Sorbonne, Paris Cité, UMR S 1142, LIMICS, Paris, France
nlarburu@vicomtech.org

***Abstract*—Breast cancer is the most common cancer in women worldwide, with around 1.7 million new cases every year, and it is a complex disease. Each case is usually discussed in multidisciplinary teams or committees, called breast units. They are composed by oncologists, surgeons, psychologists and other specialist, and they use to have very limited time, around 3 to 10 minutes per patient, to make a treatment decision. Some cases may be quite "easy", but 10-20% of the cases are not so clear - what we called "grey areas", and they may not be supported by clinical guidelines, which are the standards used by clinicians to make treatment decisions. Therefore, we need tools to support clinicians in their decision making process. For that DESIREE, the system presented in this demo, is composed by three main components: (i) an image based breast and tumour characterization tool, (ii) a predictive model after breast conservative therapy and radio-biological model, and (iii) a clinical decision support system with three main components: a guideline based CDSS, which implements various international and local guidelines; a similarity based CDSS, where its possible to explore given treatments to closest patients, and the most significant variables they share with the patient to treat; and the experience based CDSS, which processes all information from previous cases and generates new knowledge, augmenting the guidelines. All these are supported by DESIMS (i.e. DESiree Information Management System), a Security and Access Control module and an image system for image and models visualization.**

Keywords-breast cancer, decision support system

I. INTRODUCTION

Dealing with breast cancer is a complex task that requires the multi-disciplinary team of the Breast Units (BU) review large amounts of information on patient cases prior to decision. These cases may last for years and accumulated information is large and very heterogenous, varying a lot from patient to patient according to the development of the disease. Furthermore, many external sources have to be reviewed, especially when there is not much evidence for the case.

Regular meetings are organized where decisions are taken by consensus which puts a lot of pressure on the BU due to the limited amount of time to discuss each case and increasing number of cases. Decisions on previous cases are not thoroughly studied as there exist no tools for an agile exploration of previous cases that integrate the needed heterogeneous sources of information for each case.

There exist only a few Decision Support Systems (DSS) based on guidelines but they are somehow too rigid and do not reflect important information about the patient case or simple there is not enough evidence for the current particular case, which limits their applicability. To overcome these problems we have developed a web-based software that pursues a better coordination and information management in the BU, DESIREE. It incorporates a novel DSS based on an advanced digital patient model, integrating all sources of relevant information for decision on the case, as well as important context information regarding the patient. Furthermore, the system is capable of modelling experience and improve the current knowledge of the model by suggesting improvements based on previous cases and outcomes, improving and boosting the process of knowledge discovery.

In the demo we will present the different modules of DESIREE, which mainly consist of the following modules:

(i) an image based breast and tumour characterization tool, which extracts valuable information for diagnosis, treatment, prognosis and follow up from the heterogenous set of image data [1]

(ii) a predictive model after breast conservative therapy and radio-biological model, which provides useful results to the clinician and patient from the very first step before conservative therapy [2]

(iii) a clinical decision support system with three main components [3]:

- a guideline based CDSS, which implements various international and local guidelines, such as National Comprehensive Cancer Network (NCCN) international guidelines and local guidelines from the hospitals involved in the project
- a similarity based CDSS, where its possible to explore given treatments to closest patients, and the most significant variables they share with the patient to treat
- an experience based CDSS, which processes all information from previous cases and generates new knowledge, augmenting the guidelines.

ACKNOWLEDGMENT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690238.

Additionally, the authors acknowledge support from the all partners involved in the project: Arivis AG, Assistance Publique – Hopitaux de Paris, Bilbomática SA, Exploración Radiológica Especiales S.L., Fundación Onkologikoa Fundazioa, Medical Innovation and Technology Single Member PC, Sistemas Genómicos SL, Houston Methodist and Unviersity of Ulster.

REFERENCES

[1] Gracia Ocaña M., López-Linares Román, K.,Maclair G., Azpíroz Puente M., Romero Martín J.A., Belloch Ugarte V., Santabárbara J., González Ballester M., Macía I. Breast tissue segmentation and density quantification from MRI using convolutional neural networks. In proceedings Int J CARS (2018) 13(Suppl 1): 1, s12-s14

[2] R. Salmon, T. C. Nguyen, A.-C. Lesage, B. L. Bass, and M. Garbey, "Clinical study and multiscale modeling to predict the esthetic outcome of Breast Conservative Therapy."

[3] N. Larburu *et al.*, "Augmenting Guideline-based CDSS with Experts' Knowledge," presented at the 10th International Conference on Health Informatics, 2017, pp. 370–376.