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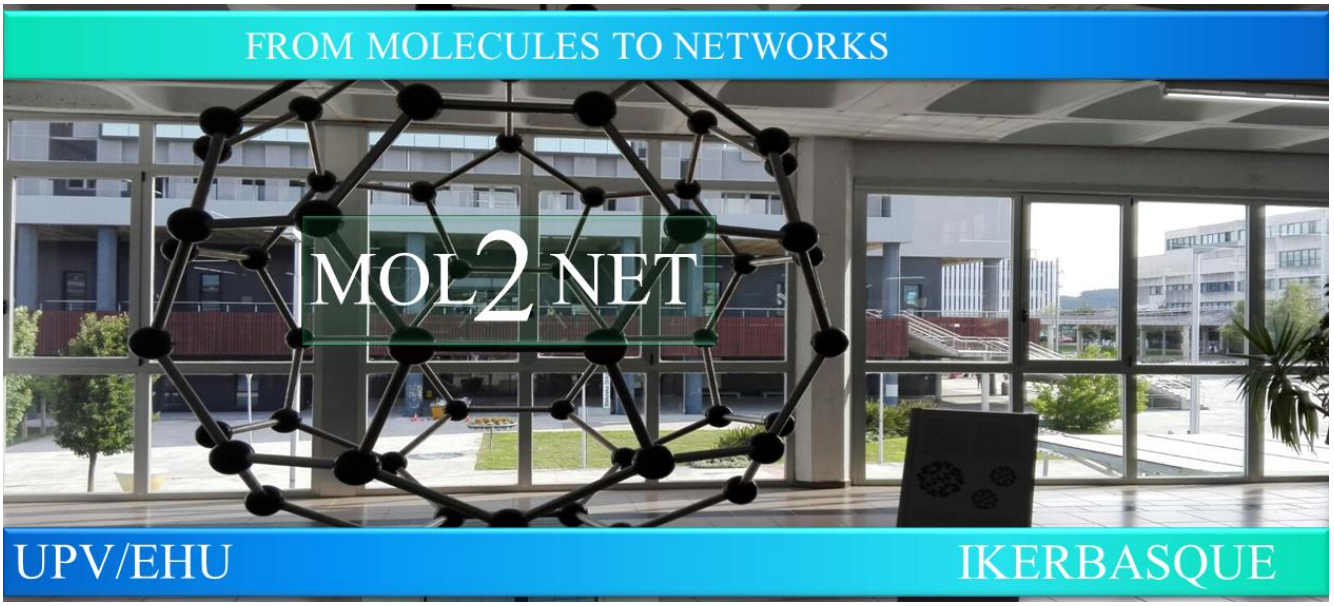

Artificial Intelligence to rapid diagnose Cystic Fibrosis

Cystic Fibrosis (CF) is an autosomal genetic disease that affects lots of people. In general, their life expectancy is lower than average, and in some cases, the diagnosis is made too late, so the complications increase. To treat the disease, apart from using a proper combination of drugs, physiotherapy and different types of analysis are needed with the aim to decrease patients' symptoms.

AI is a field of computer science that can simulate the functions of a human brain. Artificial Neural Networks (ANN) is used to determine hard real-life problems without creating a model. An ANN consists of individual processing units that store, process and transmits information. As well as ANN, Deep Learning (DL) is used. An example of it is Deep Convolutional Neural Network (DCNN) which is a class of ANN, most commonly applied to analyze visual imagery.

The first review was published by Titus Slavici and Bogdan Almajan in the Journal of Rehabilitation Medicine[1]. The objective of this study is to construct an application with which it will be possible to determine the most effective type of physiotherapy exercise for improving the health state of an individual with CF. To carry it out, relevant data from 42 children were collected. The collected data consisted of one input with 12 elements (general clinical state, nutritional status, respiratory infection case, Forced Expiratory Flow (FEF), Forced Expiratory Volume in 1 second (FEV_1), type of exercise

that should be followed by the patient to achieve the corresponding health indicators, etc), 1 hidden layer with 13 elements and an output layer with 11 elements (elements that describe the health state indicators at the end of the standard surveillance period corresponding to initial data).

As a result, the predictive tool estimates with an accuracy of 93% the effects of some physiotherapy exercises on the health status of the patients.

The second paper was published by Eva J. Zuckera, Zachary A. Barnesb, et al, in the Journal of Cystic Fibrosis. This study aimed to evaluate the hypothesis that a DCNN model could facilitate automated Brasfield scoring of chest radiographs (CXRs) for patients with CF, performing similarly to a pediatric radiologist. The Brasfield scoring for the chest radiographs are used to compare patients and different treatment regimens, and to monitor respiratory disease in individual patients[2].

To perform it the following process was done (Figure 1).

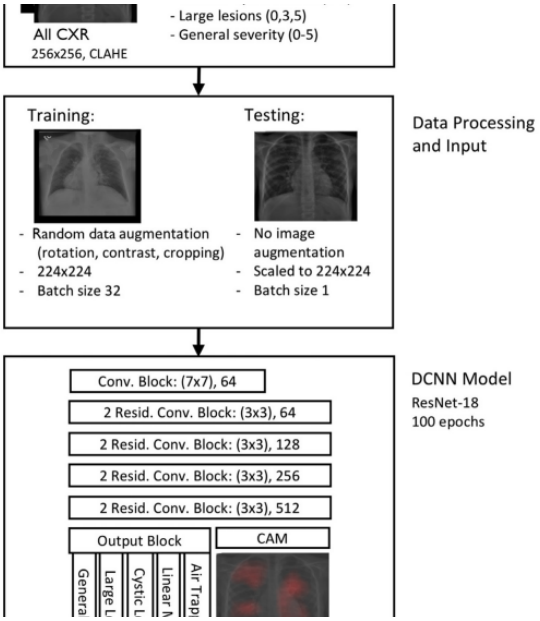

Figure 1. Schematic representation of the development of the DCNN process[3].

To evaluate the model a standard document was created. Regarding the statistical analysis, Spearman correlation was used to evaluate the predictive level of the DCNN model compared to the pediatric radiologists. Also, the mean difference, mean absolute difference, and root mean squared error between the model and reference were determined. As a result, the development of a DCNN model for automating Brasfield scoring with accuracy similar to that of a pediatric radiologist was performed.

Taking into account what the previous papers explained, the authors have in common that they have developed an AI model to apply to CF in order to improve the health of the patients that suffer from this disease. The authors of the first paper have developed an ANN model to predict the most suitable physiotherapy exercise for each patient, whereas the authors of the second paper have developed a

DCNN model that can predict Brasfield scoring of CXRs for patients. Although the models used are different, both of them are focused on AI.

I personally think that the two papers are complementary to each other despite the aim of each study is not the same, because if you can first monitor the respiratory disease in the individual, you have more information about it and consequently you will predict a more appropriate physiotherapy exercise.

In conclusion, in my opinion, AI is a very useful instrument that may help in the quality of medical services. Also, considering that fewer experimental processes are needed, the amount of money utilized will be lower.

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[1]Titus Slavici, Bogdan Almajan. Artificial intelligence techniques: an efficient new approach to challenge the assessment of complex clinical fields such AS Airway Clearance Techniques in patients with cystic fibrosis. Journal Rehabilitation Medicine (45:397-402). 2013.

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[3]Evan J. Zuckera, Zachary A. Barnesb, Matthew P. Lungrena, Yekaterina Shpanskayaa, Jayne M. Seekinsa, Safwan S. Halabia, David B. Larsona. Deep learning to automate Brasfield chest radiographic scoring for cystic fibrosis. Journal of Cystic Fibrosis (19:131-138). 2020.