

Deep Transfer Learning for Alzheimer's disease detection

Nicole Dalia Cilia, Claudio De Stefano, Claudio Marrocco, Francesco Fontanella, Mario Molinara and Alessandra Scotto di Freca

Department of Electrical and Information Engineering, University of Cassino and Southern Lazio, Via Di Biasio 43, 03043 Cassino (FR), ITALY

Email: (nicoledalia.cilia, destefano, c.marrocco, fontanella, m.molinara, a.scotto)@unicas.it



- Early detection of Alzheimer's Disease (AD) is essential in order to initiate therapies that can reduce the
 effects of such a disease, improving both life quality and life expectancy of patients.
- Among all the activities carried out in our daily life, handwriting seems one of the first to be influenced by the arise of neurodegenerative diseases. For this reason, the analysis of handwriting and the study of its alterations has become of great interest in this research field in order to make a diagnosis as early as possible.
- In recent years, many studies have tried to use classification algorithms applied to handwriting to implement decision support systems for AD diagnosis. A key issue for the use of these techniques is the detection of effective features, that allow the system to distinguish the natural handwriting alterations due to age, from those caused by neurodegenerative disorders.
- In this context, many interesting results have been published in the literature in which the features have been typically selected by hand, generally considering the dynamics of the handwriting process in order to detect motor disorders closely related to AD. Features directly derived from handwriting generation models can be also very helpful for AD diagnosis.



- It should be remarked, however, that the above features do not consider changes in the shape of handwritten traces, which may occur as a consequence of neurodegenerative diseases, as well as the correlation among shape alterations and changes in the dynamics of the handwriting process.
- Moving from these considerations, the aim of this study is to verify if the combined use of both shape and dynamic features allows a decision support system to improve performance for AD diagnosis.
- To this purpose, starting from a database of on-line handwriting samples, we generated for each of them
 a synthetic off-line colour image, where the colour of each elementary trait encodes, in the three RGB
 channels, the dynamic information associated to that trait.
- Finally, we exploited the capability of Deep Neural Networks (DNN) to automatically extract features from raw images, following the Transfer Learning approach.
- The experimental comparison of the results obtained by using standard features and features extracted according the above procedure, confirmed the effectiveness of our approach.



The architecture of the whole system





Thanks everyone for your attention!

I will be happy to answer your questions and comments ...