Deep Learning in the pursuit of Happiness

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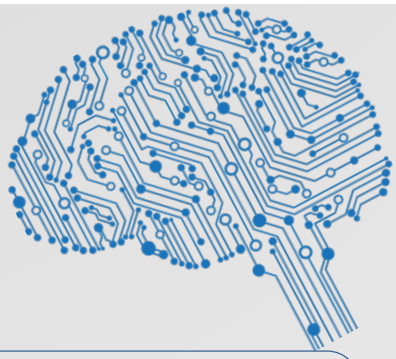


INTRODUCTION

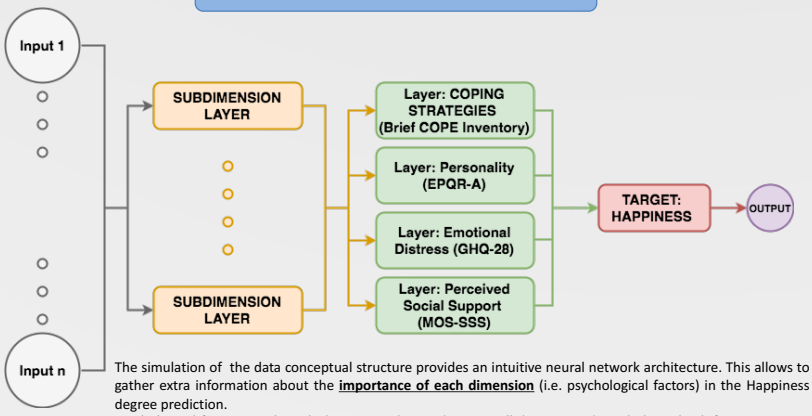
Happiness is a fundamental human goal. Since the emergence of Positive Psychology as the scientific study of factors that lead humans (both at the individual and collective level) to thrive, the research community has consistently built up the evidence-based knowledge about the so-called happiness or subjective well-being.

Happiness and depression are terms employed in daily life to denote affective states and mood swings, which are reliably represented as falling at opposite ends of a bipolar valence continuum.

Emerging paradigms, novel approaches, and tools such as deep learning are becoming increasingly influential in psychological research as in the case of Emotion recognition [1], sentiment analysis and/or classification [2].

We propose the construction of a Data-Structure driven Deep Neural Network (D-SDNN) for supervised learning based on the conceptual structure of the psychological factors –stress coping strategies, personality, emotional distress, and perceived social support- measured by 4 standardized psychometric scales (Brief COPE Inventory, EPQR-A, GHQ-28 and MOS-SSS, respectively) as approach in the prediction of Happiness measured in terms of the psychometric Short Depression-Happiness Scale (SDHS).

CONCEPTUAL SCHEME



The simulation of the data conceptual structure provides an intuitive neural network architecture. This allows to gather extra information about the **importance of each dimension** (i.e. psychological factors) in the Happiness degree prediction.
Psychological factors can be sub-dimensioned according to well-documented psychological sub-factors creating the architecture of the neural networks.

WEIGHTS METRICS

Let n be the number of inputs in the neuron j of the layer L, and w denotes the weight of the inputs in neuron j of the layer L:

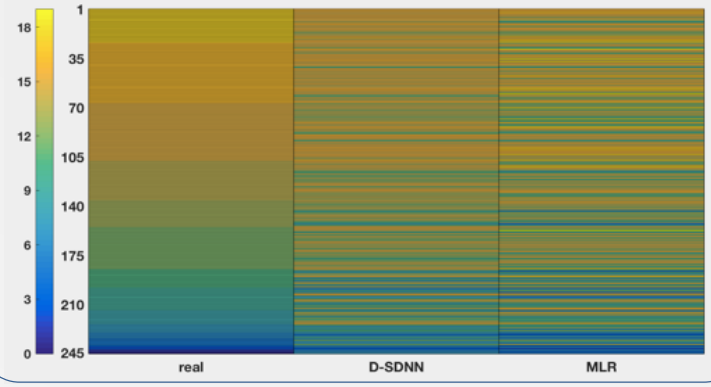
$$L_i^{(j)} = \sum_{i=1}^{n} w_{ij}$$

The positivity or negativity of the relationship is determined by:

$$sgn\left(L_i^{(j)}\right) = sgn\left(\sum_{i=1}^{n} w_{ij}\right)$$

RESULTS

D-SDNN approach provided a better outcome (MSE: $1.46 \cdot 10^{-2}$) than traditional methodologies such as Multivariate Linear Regression (MLR) (MSE: $2.32 \cdot 10^{-2}$), hence improving by 37% the predictive accuracy, and allowing to simulate the conceptual structure.



CONCLUSIONS

- The deep learning architecture has been driven by the conceptual data structure for the pre- diction of Happiness.
- The lower-level dimensions of psychological factors are separately ensembled for then being merged by higher-level dimensions until happiness is reached.
- Better performance of Deep Neural Networks with respect to traditional methodologies, such as Multivariate Linear Regression (MLR).
- Capability to capture the conceptual structure for predicting happiness degree through psychological variables assessed by standardized questionnaires.
- Estimation of the influence of each factor on the outcome without assuming a linear relationship.
- The prediction of happiness is improved by not assuming linear relationships between factors.

The results presented in this poster can be extended:
- F.J. Pérez-Benito, P. Villacampa-Fernández, J.A. Conejero, J.M. García-Gómez, E. Navarro-Pardo, A happiness degree predictor using the conceptual data structure for deep learning architectures. Submitted to Computer Methods and Programs in Biomedicine.

[1] E. M. Schmidt, Y. E. Kim, Learning emotion-based acoustic features with deep belief networks, in: Applications of Signal Processing to Audio and Acoustics (WASPAA), 2011 IEEE Workshop on, IEEE, 2011, pp. 65-68.
[2] T. Chen, D. Borth, T. Darrell, S.-F. Chang, Deepsentibank: Visual sentiment concept classification with deep convolutional neural networks, arXiv preprint arXiv:1410.8586.