BIG DATA IN MEDICINE

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Abstract

- The modern researches in medicine are based on large datasets, with lot of complex and unconventional cases, where clasical statistical methods are usually inapplicable for the data analysis.
- In that case, methods of machine learning are better solution, since they can learn complex relationships from known data and than apply this knowledge on unknown data.
- Here will be presented the use of artificial neural network (ANN) for medical predictions.

Predicting body fat percentage based on gender, age and BMI by using artificial neural networks

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BODY FAT PERCENTAGE

- In the human body, the relation between fat and fat-free mass (muscles, bones etc.) is necessary for the diagnosis of obesity and prediction of its comorbidities.
- Numerous formulas, such as *Deurenberg et al*., *Gallagher et al*., *Jackson and Pollock*, *Jackson et al*. etc., are available to predict body fat percentage (BF%) from gender (GEN), age (AGE) and body mass index (BMI).

IDEA

- These formulas are all fairly similar and widely applicable, since they provide an easy, low-cost and non-invasive prediction of BF%.
- This paper presents a program solution for predicting BF% based on artificial neural network (ANN).

EXPERIMENT

- ANN training, validation and testing are done by randomly divided dataset that includes **2755 subjects**
- 1332 women (GEN = 0) and 1423 men (GEN = 1), with AGE from 18 to 88 y and BMI from 16.60 to 64.60 kg/m2.
- BF% was estimated by using Tanita bioelectrical impedance measurements (Tanita Corporation, Tokyo, Japan).

RESULTS

- ANN inputs are: GEN, AGE and BMI, and output is BF%.
- The predictive accuracy of our solution is 80:43%.
- The main goal of this paper is to promote a new approach to predicting BF% that has same complexity and costs but higher predictive accuracy than above-mentioned formulas.

ANN

- ANN takes known data, i.e. previously solved examples, recognizes complex patterns between inputs and outputs and then applies this knowledge on unknown data.
- The hidden relationships between inputs and outputs are learned so subsequently ANN is able to predict the output from a given input of new data.

FORMULAS

Deurenberg et al. formula

$$BF\% = 1.20 \cdot BMI + 0.23 \cdot AGE - 10.80 \cdot GEN - 5.40$$

Deurenberg et al. formula

$$BF\% = 1.29 \cdot BMI + 0.20 \cdot AGE - 11.40 \cdot GEN - 8.00$$

Gallagher et al formula

$$BF\% = 1.46 \cdot BMI + 0.14 \cdot AGE - 11.60 \cdot GEN - 10.00$$

FORMULAS

Jackson and Pollock formula

$$BF\% = 1.61 \cdot BMI + 0.13 \cdot AGE - 12.10 \cdot GEN - 13.90$$

Jackson et al. formula

$$BF\% = 1.39 \cdot BMI + 0.16 \cdot AGE - 10.34 \cdot GEN - 9.00$$

COMPARATION

Table 4: The comparing ANN with formulas $(F_1 - F_5)$.

Method	${}^{AV}MPA\% \pm {}^{STD}MPA\%$	$\Delta\%$
ANN	80.43 ± 1.48	—
(F_1)	77.31 ± 1.55	$+3.12$
(F_2)	79.20 ± 1.39	$+1.23$
(F_3)	78.95 ± 1.34	$+1.48$
(F_4)	78.10 ± 1.26	$+2.33$
(F_5)	78.61 ± 1.41	$+1.82$

CONCLUSIONS

- ANN showed higher predictive accuracy for +1.23% to +3.12%.
- Based on that, we conclude that this paper presented a new approach to predicting BF% that has same complexity and costs but higher predictive accuracy.

THANK YOU!