A summary of "description of multivariate time series by means of trends characterization in the fuzzy domain"

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Abstract. This is a summary of our article published in Fuzzy Sets and Systems [1] (JCR Impact Factor 2014: 1.986) to Multi-Conference CAEPIA15 KeyWorks.

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1 Generation of automatic descriptions

MTS can be found in a different type of systems and contains more than one variable. Great efforts have been made to directly extract text from MTS. In the paper presented in [1] the linguistic description process is understood as a method to automatically synthesize a text and describe the most interesting knowledge obtained from the numerical data. The main aim of the proposed method consist in to generate a linguistic description of an MTS using a representation based on fuzzy logic that analyzes the trends on the input and the output variable. The use of trends shows the MTS variable evolution and the relation among them. It can be considered as a way to provide a coarser informed analysis of the MTS. The method needs the support of an expert when the structure of the linguistic descriptions has been defined. Finally, the experimentation is focused on the description of a countermovement jump (CMJ).

To obtain the linguistic descriptions four phases has been done:

1. A TFM is induced using the induction algorithm described in [2].
2. A structure called the set of trends TRENDS is calculated using the obtained TFM as input. A structure called POINTS (minima and maxima) is computed since they are interesting to the descriptions guided by experts.
3. An expert in the application field must given in detail all possible indicators that are modelled as events. This phase tries to find the occurrences of these events in TRENDS and POINTS.
4. Finally, a linguistic description is created by means of the detected events.

To test the method six linguistic descriptions have been generated using a set of six different MTS (six CMJ). Position and velocity were the input variables, and force was the output variable. The six input MTS were registered on

a Kistler Quattro Jump force platform (Kistler, Switzerland), connected to a portable computer where the force data were recorded. A Java application using Eclipse IDE has been implemented to compute the structures TRENDS and POINTS, to search for the occurrence of the events, and finally to generate the linguistic description. The type of CMJ is classified as *lower jump*, *higher jump*, and *good jump executed by a non-explosive jumper*. An example of obtained linguistic description (correspond to Test 5 and activates the events 3, 4a and 7 and classifies jump as a lower jump) is the following:

The jump height achieved is lower due to an excessive descent of the center of gravity. The jump height achieved is lower since the first maximum is much greater than the second one in phase 3. This represents an excessive lowering of the center of gravity. The jump height is lower since the take-off of the jump is extended in time. Not an explosive movement. This jump can be classified as a lower jump.

Test	**Events**	**CMJ type**	**classification**
1	2 (events 1 and 4)	lower	ok
2	1 (event 5b)	low explosive	ok
3	1 (event 6b)	higher	ok
4	1 (event 5b)	low explosive	ok
5	3 (events 3, 4b and 7)	lower	ok
6	2 (events 1 and 4b)	lower	ok

The above table summarizes the obtained results. It contains the identification of the test, the number of detected events and their indices, the type of detected CMJ (column 3), and whether the expert validated the classification.

2 Conclusions

Our proposal is oriented to events, and this fact allows the experts to indicate the sought for knowledge. Our events are independent of the software structures, so the set of events can be modified without affecting them. This property allows the expert to add new events. The selected application field is sports. As future research, the definition of events should be formalized.

References

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