# FUZZY EQUIVALENCE RELATION BASED APPROXIMATIONS OF A T-NORM EXTENSION OF AGGREGATION OPERATORS[1]

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In this talk we develop the concept of upper and lower general aggregation operators based on a fuzzy equivalence relation. In our previous works [1] and [2] we introduced and studied approximations of a pointwise extension $\tilde{A}$ of an ordinary aggregation operator $A \colon [0,1]^n \to [0,1]$. Let $T$ be a left continuous t-norm, $\overrightarrow{T}$ be its residuum and $E$ be a $T$-fuzzy equivalence relation defined on a set $X$. The upper and lower general aggregation operators $\tilde{A}_{E,T}$ and $\tilde{A}_{E,\overrightarrow{T}}$ have been defined respectively by

$$\tilde{A}_{E,T}(\mu_1,\ldots,\mu_n)(x) = \sup_{x' \in X} T(E(x,x'), A(\mu_1(x'),\ldots,\mu_n(x'))),$$

$$\tilde{A}_{E,\overrightarrow{T}}(\mu_1,\ldots,\mu_n)(x) = \inf_{x' \in X} \overrightarrow{T}(E(x,x')|A(\mu_1(x'),\ldots,\mu_n(x'))),$$

where $x \in X$ and $\mu_1,\ldots,\mu_n \in [0,1]^X$.

Now we consider approximations of the t-norm based extension $\tilde{A}^T$ of aggregation operator $A$. The constructions of upper and lower general aggregation operators $\tilde{A}^T_{E,T}$ and $\tilde{A}^T_{E,\overrightarrow{T}}$ are defined in the following way:

$$\tilde{A}^T_{E,T}(\mu_1,\ldots,\mu_n)(x) = \sup_{x'=A(x_1',\ldots,x_n')} T(E(x,x'), T(\mu_1(x_1'),\ldots,\mu_n(x_n'))),$$

$$\tilde{A}^T_{E,\overrightarrow{T}}(\mu_1,\ldots,\mu_n)(x) = \inf_{x'=A(x_1',\ldots,x_n')} \overrightarrow{T}(E(x,x')|T(\mu_1(x_1'),\ldots,\mu_n(x_n'))),$$

where $x,x',x_1',\ldots,x_n' \in [0,1]$ and $\mu_1,\ldots,\mu_n \in [0,1]^{[0,1]}$. We study properties of these constructions which are important in the context of aggregation of fuzzy sets.

**REFERENCES**

[1] P. Orlovs, S. Asmuss. Upper and lower generalized factoraggregations based on fuzzy equivalence relation. In: *Proc. of the Intern. Conference on Fuzzy Systems FUZZ-IEEE 2014*, Beijing, 2014, 1772 – 1777.

[2] P. Orlovs, S. Asmuss. On extensional fuzzy sets generated by factoraggregation. In: *Proc. of the 15th Inter. Conference IPMU 2014*, Communications in Computer and Information Science 444(3), Springer-Verlag, 2014, 317 – 326.