

Analogical proportions: from Boolean to nominal and beyond...

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Abstract

Analogical proportions provide a tool for formalizing analogical inference in a way that has been empirically verified to be efficient in various classification and reasoning tasks. Analogical proportions are statements of the form a is to b as c is to d , where a, b, c, d are tuples of attribute values describing objects, instances, etc. The mechanism of analogical inference started to be better understood when the characterization of the class of classifiers with which the analogical inference always agrees was established for Boolean attributes. This result was recently extended to nominal attributes.

The purpose of this talk is to discuss some key cognitive aspects related with analogical proportions (inference and creativity), recent applications in AI and ML, and present some characterization results, namely, the description of classifiers compatible with the analogical principle. In particular, we will show that in the Boolean case the classifiers compatible with analogical inference correspond exactly to affine Boolean functions. We will extend this result to the nominal case and, by making good use of Jablonski's Lemma, we will show that the binary classifiers over nominal attributes correspond to so-called quasi-linear functions.

If time allows, we will also discuss some open problems and potentially beneficial cross-field interactions. The results were presented in (Couceiro et al. 2017), (Couceiro et al. 2018) and (Couceiro et al. 2020) obtained in collaboration with Nicolas Hug, Erko Lehtonen, Laurent Miclet, Henri Prade, and Gilles Richard.

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