

Evaluation Measures for Quantification: An Axiomatic Approach

Fabrizio Sebastiani^(✉) 

Istituto di Scienza e Tecnologie dell'Informazione,
Consiglio Nazionale delle Ricerche, 56124 Pisa, Italy
`fabrizio.sebastiani@isti.cnr.it`

Abstract. Quantification is the task of estimating, given a set σ of unlabelled items and a set of classes $\mathcal{C} = \{c_1, \dots, c_{|\mathcal{C}|}\}$, the prevalence (or “relative frequency”) in σ of each class $c_i \in \mathcal{C}$. While quantification may in principle be solved by classifying each item in σ and counting how many such items have been labelled with c_i , it has long been shown that this “classify and count” (CC) method yields suboptimal quantification accuracy. As a result, quantification is no longer considered a mere byproduct of classification, and has evolved as a task of its own. While the scientific community has devoted a lot of attention to devising more accurate quantification methods, it has not devoted much to discussing what properties an *evaluation measure for quantification* (EMQ) should enjoy, and which EMQs should be adopted as a result. This paper lays down a number of interesting properties that an EMQ may or may not enjoy, discusses if (and when) each of these properties is desirable, surveys the EMQs that have been used so far, and discusses whether they enjoy or not the above properties. As a result of this investigation, some of the EMQs that have been used in the literature turn out to be severely unfit, while others emerge as closer to what the quantification community actually needs. However, a significant result is that no existing EMQ satisfies all the properties identified as desirable, thus indicating that more research is needed in order to identify (or synthesize) a truly adequate EMQ.

Keywords: Quantification · Supervised prevalence estimation · Divergences · Evaluation measures

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