

## Quantitative types for pair-patterns

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**Abstract.** In this talk, we explore recent approaches to quantitative typing systems for programming languages with pattern matching features. Quantitative (non-idempotent intersection) types have been used to characterise solvability for a pair pattern calculus, in which a qualitative characterisation of head-normalisation was given by means of typability.

We show that one can go further and provide upper-bounds/exact measures for head-normalisation, by means of two resource-aware quantitative type systems (system  $U$  and system  $E$ ), which take advantage of specific technical tools. While system  $U$  provides upper bounds for the length of head-normalisation sequences and the size of normal forms, system  $E$  goes even further and produces exact measures for each of them, as well as discriminating between the different kinds of reduction steps performed.