Cut-Elimination by Evaluation for a Constructive Calculus of Proofs and Refutations with Linear Connectives

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Dual calculi [1] have been investigated for some time as calculi for classical logic. Dual calculi lack elimination forms using proof-by-contradiction and duality to simulate elimination forms; however, this cause a loss of constructivity. More recently elimination forms have been discussed [2], although the work op. cit. uses two forms of negation that are not involutive between proofs and refutations. Shulman [3] advocates for a switch towards linear/affine calculi maintaining constructivity and involutive negation. Shulman deviates from traditional dual calculi by minimising the rôle of formal contradictions. In this talk we present work on formalising cut-elimination by evaluation for a constructive calculus of both introduction and elimination forms using all linear connectives. We recover the negations of [2] by composing our negations with exponentials, and expose the structure of contradictions in [3]. We conclude by deducing soundness from the cut-elimination proof.

[1] https://homepages.inf.ed.ac.uk/wadler/topics/dual.html
[2] https://dl.acm.org/doi/10.1145/3547637
[3] https://arxiv.org/abs/1805.07518