

Refutation of differential reasoning

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Abstract: We refute Hempel's raven paradox elsewhere, hence refuting differential reasoning which forms a *non* tautologous fragment of the universal logic VL4.

We assume the method and apparatus of Meth8/VL4 with Tautology as the designated proof value, **F** as contradiction, **N** as truthity (non-contingency), and **C** as falsity (contingency). The 16-valued truth table is row-major and horizontal, or repeating fragments of 128-tables, sometimes with table counts, for more variables. (See ersatz-systems.com.)

LET \sim Not, \neg ; + Or, \vee , \cup , \sqcup ; - Not Or; & And, \wedge , \cap , \sqcap , \cdot , \otimes ; \ Not And;
> Imply, greater than, \rightarrow , \Rightarrow , \mapsto , $>$, \supset , \rightarrow ; < Not Imply, less than, \in , $<$, \subset , \prec , $\#$, \ll , \lesssim ;
= Equivalent, \equiv , $:=$, \Leftrightarrow , \leftrightarrow , $\hat{=}$, \approx , \cong ; @ Not Equivalent, \neq , \oplus ;
% possibility, for one or some, \exists , \diamond , **M**; # necessity, for every or all, \forall , \square , **L**;
($z=z$) **T** as tautology, \top , ordinal 3; ($z@z$) **F** as contradiction, \emptyset , Null, \perp , zero;
(% $z>\#z$) **N** as non-contingency, Δ , ordinal 1; (% $z<\#z$) **C** as contingency, ∇ , ordinal 2;
 $\sim(y < x)$ ($x \leq y$), ($x \subseteq y$), ($x \sqsubseteq y$); ($A=B$) ($A\sim B$).

Note for clarity, we usually distribute quantifiers onto each designated variable.

From: van Krieken, E.; Acar, E.; van Harmelen, F. (2019). Semi-supervised learning using differentiable reasoning. arxiv.org/pdf/1908.04700.pdf

Abstract We introduce Differentiable Reasoning (DR), a novel semi-supervised learning technique which uses relational background knowledge to benefit from unlabeled data. We apply it to the Semantic Image Interpretation (SII) task and show that background knowledge provides significant improvement. We find that there is a strong but interesting imbalance between the contributions of updates from Modus Ponens (MP) and its logical equivalent Modus Tollens (MT) to the learning process, suggesting that our approach is very sensitive to a phenomenon called the Raven Paradox... We propose a solution to overcome this situation.

1 Introduction Semi-supervised learning is a common class of methods for machine learning tasks where we consider not just labeled data, but also make use of unlabeled data... This can be very beneficial for training in tasks where labeled data is much harder to acquire than unlabeled data. This can be very beneficial for training in tasks where labeled data is much harder to acquire than unlabeled data. ... In the experimental analysis, we find that the gradient updates using the Modus Ponens (MP) and Modus Tollens (MT) rules are disproportionate. That is, MT often strongly dominates MP in the learning process. Such behavior suggests that our approach is highly sensitive to the Raven Paradox... It refers to the phenomenon that the observations obtained from “All ravens are black” are dominated by its logically equivalent “All non-black things are non-ravens”.

We refute Hempel's raven paradox elsewhere, hence refuting differential reasoning. (See for example: vixra.org/pdf/1908.0274v1.pdf; and “Logical induction is not tautologous via the Black raven paradox and Kripkenstein”, ersatz-systems.com/RA.Meth8.refut.valid.abstract.pdf.)