Practical Implementation of Deep Differentiable Logic Gate Networks: Design and Benchmarks

Author 1 Affiliation | Author 2 Affiliation | Author 3 Affiliation | Author 4 Affiliation

August 19, 2025

Abstract

Write abstract here [**?**]

1 Introduction

The introduction section should:

- contextualize the problem and explain why it is important;
- clarify the limitations of existing solutions;
- state the main contributions (with clear bullet points);
- provide a brief overview of the paper structure.

Contributions List 2–4 main contributions clearly.

2 Related Work

Critical review of related work; organize by themes (e.g.: models, architectures, metrics, applications). Cite works using `\citep` or `\citet` (with `natbib`; see the attached .bib file).

3 Method

Describe the proposed method in detail. Use subsections for clarity.

3.1 Problem formulation

Mathematical statement of the problem, notation and assumptions.

3.2 Architecture / Algorithm

Present the architecture (diagrams) or the algorithm in pseudo-code.

Algorithm 1 Example algorithm

Require: dataset $\mathcal{D}$, hyperparameters θ
Ensure: trained model M
for each epoch $e = 1, \ldots, E$ **do**
  for batch b in $\mathcal{D}$ **do**
    compute loss $\mathcal{L}$
    update parameters via optimizer
  end for
end for

4 Experimental Setup

Provide details on:

- dataset (source, splits, preprocessing);
- evaluation metrics;
- architectures and hyperparameters;
- experimental environment (GPU, seed, library versions).

Reproducibility: indicate whether the code/data are public (link to repo).

5 Results

Present quantitative and qualitative results.

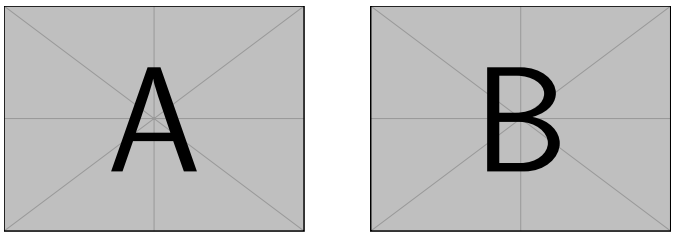
5.1 Quantitative results

Table 1: Main results on dataset X.

Method	Accuracy (%)	F1	Time (s)
Baseline A	85.2	0.84	120
Proposed Method	**89.7**	**0.88**	150

5.2 Qualitative results

Include visual examples, heatmaps or use cases.



(a) Example A (b) Example B

Figure 1: Qualitative examples of the proposed model.

6 Ablation Study

Analyze key model components to show what contributes to performance.

7 Discussion

Interpretation of results, limitations, ethical considerations if relevant, possible applications and impact.

8 Conclusion and Future Work

Summary of contributions and directions for future work.

Acknowledgments

Acknowledgments to organizations, funding and collaborators.

References

[1] Felix Petersen, Christian Borgelt, Hilde Kuehne, and Oliver Deussen. Deep differentiable logic gate networks, 2022.

A Implementation details

Parameters, additional pseudocode, mathematical proofs.

B Supplementary results

Additional plots and tables.