# Seminar Thesis

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# fairML - a Case study of the SQF dataset

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Supervised by Dr. Ludwig Bothmann

## Abstract

In this study we aim to quantify the uncertainty in image labelling, a critical aspect in the performance of machine learning models. Using the CIFAR-10H dataset, which includes human-labelled images with multiple annotations per image, we applied a Bayesian Latent Class Mixture Model to estimate the true labels and the associated uncertainty. We employed a Stochastic Expectation-Maximization algorithm for parameter estimation. Our analysis identified significant sources of labelling uncertainty, including image ambiguity, subcategory ambiguity, and annotator reaction times. The findings highlight the importance of considering different sources of labelling uncertainty and show the validity of the proposed methodology by comparing the results obtained under the assumption of missing true labels to the results obtained with the true labels.

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# A Electronic Appendix

Data, code and illustrations are available in electronic form.

# References

Battleday, R. M., Peterson, J. C. and Griffiths, T. L. (2020). Capturing human categorization of natural images by combining deep networks and cognitive models, *Nature Communications* **11**(1): 5418.

# Declaration of authorship

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Munich, December, 9th 2024

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