# Dispersed Binomial Frequencies for the Modelling of Ink Transmission on Paper

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The motivation for this work is the problem of missing ink transfer on sack paper. The aim is to discover dependencies between successful printing ink transfer and paper properties (e.g. topography or formation) in order to gain a better knowledge of the underlying processes. Samples from different sack papers were considered and surveyed with logistic regression models. But some of the resulting models display overdispersion whereas others feature underdispersion.

Therefore, this work focuses on two distributions that can account for the additional or lesser variability of the data compared to the classic binomial distribution. Those two distributions are the multiplicative binomial distribution first introduced by Altham (1978) and the double binomial distribution as introduced by Efron (1986). Both distributions originate from the classic binomial distribution but carry an additional parameter that enables the distribution to react to variabilities smaller or larger than in the binomial case.

An overview of these distributions will be given, followed by an embedding into the framework of generalized linear models. Simulation results will show the performance of the parameter estimation via maximum likelihood estimation. The presentation will close with a comparison of the three models resulting from the different distributions (classic, multiplicative and double binomial), applied to the dataset of successful or failed ink transfer. For more details, see Feirer, Friedl, Hirn, and Bauer (2012).

## References

Altham, P. (1978). Two generalizations of the binomial distribution. *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, *27*(2), 162-197.

Efron, B. (1986). Double exponential families and their use in generalized linear regression. *Journal of the American Statistical Association*, *81*(395), 709-721.

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