Abstract

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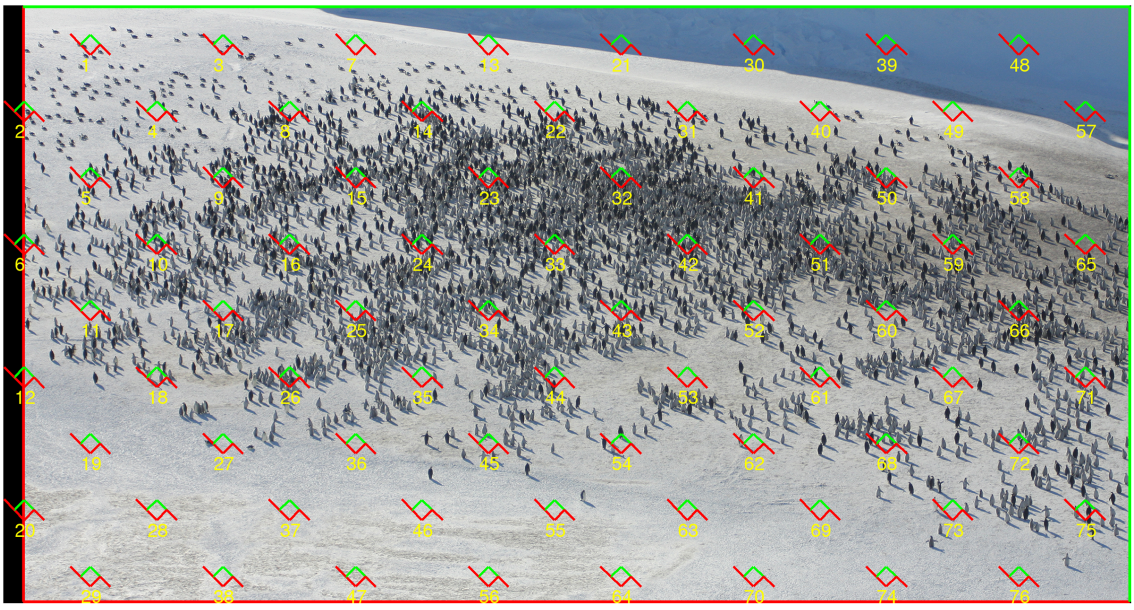
Design unbiased population size estimation

Joint with Javier González-Villa

Population sizing is essential in ecological and social sciences and relevant to many real world applications such as demonstrations, political rallies, concerts, marathons, etc. Manual counting on images is slow, tedious and observer dependent, while automatic computer recognition methods are biased and are known to fail for large populations. We proposed ([1]) a design unbiased method, based on geometric sampling principles which are largely unknown outside the areas of three dimensional microscopy and stereology. The performance of the method was checked on 51 manually annotated images with population sizes between 96 and 4633 ([2]). The relative standard error was shown to be in the 5%–10% range through automatic Monte Carlo replicated sampling on the manually annotated positions. In addition we proposed a variance estimator which contemplates quadrat dependence using the Cavalieri slices design ([4]). In [3] we show how to reduce the variance caused by inhomogeneous population patterns that arise in gigapixel images due to perspective artifacts. The source code and software of the method are avaliable at `http://countem.unican.es`.



References

[1] Cruz M, Gómez D, Cruz-Orive LM (2015). Efficient and Unbiased Estimation of Population Size. PLoS ONE 10(11):e0141868. doi:10.1371/journal.pone.0141868.

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[3] Cruz, M., & González-Villa, J. (2018b). Unbiased Population Size Estimation on Still Gigapixel Images (OnlineFirst). *Sociological Methods & Research*, Doi: 10.1177/0049124118799373.

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