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Learning probabilities from random observables in high dimensions: the maximum entropy distribution and others TOMOYUKI OBUCHI[1], Tokyo Institute of Technology, SIMONA COCCO, Laboratoire de Physique Statistique de lEcole Normale Superieure, REMI MONASSON, Laboratoire de Physique Theorique de lEcole Normale Superieure — We consider the problem of learning a target probability distribution over a set of N binary variables from the knowledge of the expectation values (with this target distribution) of M observables, drawn uniformly at random. The space of all probability distributions compatible with these M expectation values within some fixed accuracy, called version space, is studied. We introduce a biased measure over the version space, which gives a boost with the entropy of the distributions and with an arbitrary 'temperature'. The choice of the temperature allows us to interpolate between the flat measure over all the distributions and the pointwise measure concentrated at the maximum entropy distribution. Using the replica method we compute the volume of the version space and other quantities of interest, such as the distance R between the target distribution and the center-of-mass distribution over the version space. Some phase transitions are found, corresponding to qualitative improvements in the learning of the target distribution and to the decrease of the distance R. However, the distance R does not vary with the temperature, meaning that the maximum entropy distribution is not closer to the target distribution than any others.

[1]I am a member of one of the reciprocal societies, The Physical Society of Japan (JPS), and put the ID of JPS above.

Tomoyuki Obuchi
Tokyo Institute of Technology

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