An investigation on classical and quantum information entropies and diversity measures

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We present a possible unification of diversity measures/indices based on information entropies in the classical world and suggest an extension to the quantum world. Motivation came from the new emerging field of quantum biology. Renyi entropy and Tsallis entropy in non-extensive statistical mechanics are two major generalized entropies parameterized by one real parameter. It can be shown that in the limiting case when the parameters approach one we obtain Shannon entropy in classical information theory. The same function is used to measure the diversity in different physical systems and it is known as the Shannon index. Motivated by this, we introduced several entropy-like functions corresponding to different values of the parameters and investigated their properties as diversity indices. Further, following the same path, we investigated the possibility of using Tsallisentropy as a good candidate for measuring diversity. Moreover, we try to find corresponding quantum versions using the Renyi and Tsallisquantum entropies. Finally, we are of the view that measures of diversities in quantum biology also will be applied to many other situations.

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