

ON THE CONCEPT OF φ -ENTROPY

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Abstract. In this paper, the concept of φ -entropy is defined and some of the its properties are proved. It is a type of generalized entropy with generalized properties. It is invariant under topological conjugacy and satisfies a generalized version of Jaccob's Theorem. Finally, we will extract the Kolmogorov entropy as a special case, by setting φ to be the identity function.

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REFERENCES

- [1] R.L. Adler, A.G. Konheim and M.H. McAndrew, *Topological entropy*, Trans. Amer. Math. Soc., **114** (1965), 309–319.
- [2] S. Arimoto, *Information-theoretic considerations on estimation problems*, Information and Control, **19** (1971), 181–190.
- [3] M. Belis and S. Guiasu, *A quantitative-qualitative measure of information in cybernetic systems*, IEEE Trans. Inform. Theory, **14** (1968), 593–594.
- [4] R. Bowen, *Invariant measures for Markov maps of the interval*, Comm. Math. Phys., **69** (1976), 1–17.
- [5] L. Breiman, *The individual theorem of information theory*, The Annals of Mathematical Statistics, **28** (1957), 809–811; **31** (1960), 809–810 (errata).
- [6] M. Brin and A. Katok, *On local entropy*, in *Geometric dynamics, Proceedings of the International Symposium held at the Instituto de Matemática Pura e Aplicada Rio de Janeiro, Brasil, July-August 1981*, Lecture Notes in Mathematics, Springer-Verlag, Berlin, **1007** (1983), 30–38.
- [7] E.I. Dinaburg, *The relation between toological entropy and metric entropy*, Soviet Math. Dokl., **11** (1970), 13–16.
- [8] C. Ferreri, *Hypoentropy and related heterogeneity, divergency and information measures*, Statistica, **40** (1980), 155–168.
- [9] J. Havrda and F. Charvát, *Quantification method of classification processes. Concept of structural α -entropy*, Kybernetika, **3** (1967), 30–35.
- [10] J.N. Kapur, *Generalized entropy of order α and type β* , Mathematics Seminar, Delhi, **4** (1967), 78–94.
- [11] J.N. Kapur, *Some new non-additive measures of entropy*, Boll. U.M.I., **7** (1988), 253–266.

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- [12] A.N. Kolmogorov, *New metric invariant of transitive dynamical systems and endomorphisms of Lebesgue spaces*, Doklady of Russian Academy of Sciences, **119** (1958), 861–864.
- [13] B.H. Lavenda, *A new perspective on thermodynamics*, Springer, New York, 2010.
- [14] B. McMillan, *The basic theorems of information theory*, The Annals of Mathematical Statistics, **24** (1953), 196–219.
- [15] Y. Pesin, *Characteristic Lyapunov exponents and smooth ergodic theory*, Russian Math. Surveys, **32** (1977), 54–114.
- [16] R. Phelps, *Lectures on Choquet's Theorem*, Van Nostrand, Princeton, 1966.
- [17] M. Rahimi and A. Riazi, *Entropy operator for continuous dynamical systems of finite topological entropy*, Bull. Iranian Math. Soc., **38** (2012), 883–892.
- [18] M. Rahimi and A. Riazi, *Entropy functional for continuous systems of finite entropy*, Acta Math. Sci. Ser. B Engl. Ed., **32** (2012), 775–782.
- [19] P.N. Rathie, *On a generalized entropy and a coding theorem*, J. Appl. Probab., **7** (1970), 124–133.
- [20] A. Rényi, *On the measures of entropy and information*, in *Proc. 4th Berkely Symp. Math. Statist. and Probl.*, University of California Press, **1** (1961), 547–461.
- [21] D. Ruelle, *An inequality for the entropy of differential maps*, Bull. Braz. Math. Soc., **9** (1978), 83–87.
- [22] A.P. Sant'Anna and I.J. Taneja, *Trigonometric entropies, Jensen difference divergence measures and error bounds*, Inform. Sci., **35** (1985), 145–155.
- [23] C. Shannon, *A mathematical theory of communication*, The Bell System Technical Journal, **27** (1948), 379–423, 623–656.
- [24] B.D. Sharma and D.P. Mittal, *New nonadditive measures of inaccuracy*, Journal of Mathematical Sciences, **10** (1975), 122–133.
- [25] B.D. Sharma and I.J. Taneja, *Entropy of type (α, β) and other generalized additive measures in information theory*, Metrika, **22** (1975), 205–215.
- [26] B.D. Sharma and I.J. Taneja, *Three generalized additive measures of entropy*, Elec. Inform. Kybern., **13** (1977), 419–433.
- [27] Y.G. Sinai, *On the notion of entropy of a dynamical system*, Doklady of Russian Academy of Sciences, **124** (1959), 768–771.
- [28] R.S. Varma, *Generalizations of Reyni's Entropy of Order α* , Journal of Mathematical Sciences, **1** (1966), 34–48.
- [29] P. Walters, *An introduction to ergodic theory*, Springer-Verlag, New York, 1982.

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