

HYBRID ZIPF–MANDELBROT LAW

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Abstract. There is a unified approach, maximization of Shannon entropy, that naturally follows the path of generalization from Zipf's to hybrid Zipf's law. Extending this idea we make transition from Zipf-Mandelbrot to hybrid Zipf-Mandelbrot law. It is interesting that examination of its densities provides some new insights of Lerch's transcendent.

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REFERENCES

- [1] H. BATEMAN, A. ERDÉLYI, *Higher Transcendental Functions* Vol. I, New York: McGraw-Hill, 1953.
- [2] E. T. JAYNES, *Information theory and statistical mechanics*, Phys. Rev. Ser. II 106 (1957), 620–630.
- [3] E. T. JAYNES, *Information theory and statistical mechanics: II*, Phys. Rev. Ser. II 108 (1957), 171–190.
- [4] S. FRONTIER, *Diversity and structure in aquatic ecosystems*, Mar. Biol. Ann. Rev. 23(1985), 253–312.
- [5] J. JAKŠETIĆ, J. PEČARIĆ, *Exponential Convexity method*, J. Convex Anal., 20(1) (2013), 181–197.
- [6] J. JAKŠETIĆ, Đ. PEČARIĆ, J. PEČARIĆ, *Some properties of Zipf-Mandelbrot law and Hurwitz ζ -function*, Math. Inequal. Appl., Accepted for publication
- [7] B. MANDELBROT, *An information theory of the statistical structure of language*, In Jackson, W. (ed.), Communication Theory, New York, Academic Press, 1953.
- [8] M. MATIĆ, C. E. M. PEARCE, J. PEČARIĆ, *Shannon's and related inequalities in information theory*, In: Rassias, TM (ed.) Survey on Classical Inequalities, pp. 127–164. Kluwer Academic, Norwell (2000).
- [9] J. PEČARIĆ, F. PROSHAN, Y. L. TONG, *Convex functions partial ordering and statistical applications mathematics in Science and Engineering*, Vol. 187., Academic Press, 1992.
- [10] M. VISSER, *Zipf's law, power laws and maximum entropy*, New J. Phys 15, 043021 (2013).
- [11] G.K. ZIPF, *Human Behavior and the Principle of Least Effort*, Addison-Wesley, Reading, MA, 1949.