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Exploring weak-periodic-signal stochastic resonance in locally optimal processors with a Fisher information metric

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Titre	Exploring weak-periodic-signal stochastic resonance in locally optimal processors with a Fisher information metric
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Auteur	Duan, Fabing [1], Chapeau-Blondeau, François [2], Abbott, Derek [3]
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Type	Article scientifique dans une revue à comité de lecture
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Résumé en anglais	For processing a weak periodic signal in additive white noise, a locally optimal processor (LOP) achieves the maximal output signal-to-noise ratio (SNR). In general, such a LOP is precisely determined by the noise probability density and also by the noise level. It is shown that the output–input SNR gain of a LOP is given by the Fisher information of a standardized noise distribution. Based on this connection, we find that an arbitrarily large SNR gain, for a LOP, can be achieved ranging from the minimal value of unity upwards. For stochastic resonance, when considering adding extra noise to the original signal, we here demonstrate via the appropriate Fisher information inequality that the updated LOP fully matched to the new noise, is unable to improve the output SNR above its original value with no extra noise. This result generalizes a proof that existed previously only for Gaussian noise. Furthermore, in the situation of non-adjustable processors, for instance when the structure of the LOP as prescribed by the noise probability density is not fully adaptable to the noise level, we show general conditions where stochastic resonance can be recovered, manifested by the possibility of adding extra noise to enhance the output SNR.
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[3] http://okina.univ-angers.fr/publications?f[author]=1973
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