

# Piano\_prosthesis

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Piano\_prosthesis presents a would-be live algorithm, a system able to collaborate creatively with a human partner. In performance, the pianist's improvisation is analysed statistically by continuously measuring the mean and standard deviation of 10 features, including pitch, dynamic, onset separation time and 'sustain-ness' within a rolling time period. Whenever these features constitute a 'novel' point in 10-dimensional feature space (by exceeding an arbitrary distance threshold) this point is entered as a marker. This process continues as the improvisation develops, accruing further marker points (usually around 15 are generated in a 10 minute performance). The system expresses its growing knowledge, represented by these multi-dimensional points, in its own musical output. Every new feature point is mapped to an individual input node of a pre-trained neural network, which in turn drives a stochastic synthesizer programmed with a wide repertoire of piano samples and complex musical behaviours. At any given moment in the performance, the current distance from all existing markers is expressed as a commensurate set of outputs from the neural network, generating a merged set of corresponding musical behaviours of appropriate complexity. The identification of new points, and the choice of association between points and network states, is hidden from the performer and can only be ascertained through listening and conjecture (as may well be case in improvising with fellow human player). The system intermittently and covertly devises connections between the human music and its own musical capabilities. As the machine learns and 'communicates', the player is invited to reciprocate. Through this quasi-social endeavour a coherent musical structure may emerge as the performance develops in complexity and intimacy. This is a new system that substitutes on-the-fly network training (previously described in detail [1]) with Euclidian distance measurements, offering considerable advantages in efficiency. There are a number of sister projects for other instruments, with corresponding sound libraries (oboe, flute, cello). Further explanation and several audio examples of full performances are available on the author's website [2].

## References

1. Young, M.: NN Music: Improvising with a 'Living' Computer. In: Kronland-Martinet, R. et al (eds.) Computer Music Modelling and Retrieval: Sense of Sounds. LNCS, vol. 4969. pp. 337--350. Springer, Heidelberg (2008)
2. <http://www.michaelyoung.info>