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Speeding up Evolutionary Search by Small Fitness Fluctuations JAKUB OTWINOWSKI, Department of Physics, Emory University, SORIN TANASE-NICOLA, Department for Cell and Molecular Biology, Uppsala University, ILYA NEMENMAN, Departments of Physics and Biology and Computational and Life Sciences Initiative, Emory University — We consider a fixed size population that undergoes an evolutionary adaptation in the weak mutation rate limit, which we model as a biased Langevin process in the genotype space. We show analytically and numerically that, if the fitness landscape has a small highly epistatic (rough) and time-varying component, then the population genotype exhibits a high effective diffusion in the genotype space and is able to escape local fitness minima with a large probability. We argue that our principal finding that even very small time-dependent fluctuations of fitness can substantially speed up evolution is valid for a wide class of models.

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