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Recognizability for sequences of morphisms

We investigate different notions of recognizability for a free monoid morphism $\sigma : \mathcal{A}^* \to \mathcal{B}^*$. Full recognizability occurs when each (aperiodic) point in $\mathcal{B}^{\mathbb{Z}}$ admits at most one tiling with words $\sigma(a)$, $a \in \mathcal{A}$. This is stronger than the classical notion of recognizability of a substitution $\sigma : \mathcal{A}^* \to \mathcal{A}^*$, where the tiling must be compatible with the language of the substitution. We show that if $|\mathcal{A}| = 2$, or if σ's incidence matrix has rank $|\mathcal{A}|$, or if σ is permutative, then σ is fully recognizable.

Next we define recognizability and also eventual recognizability for sequences of morphisms (σ_n) which define an S-adic shift. We prove that a sequence of morphisms on alphabets of bounded size, such that compositions of consecutive morphisms are growing on all letters, is eventually recognizable for aperiodic points. In particular if each σ_n is fully recognizable, then the S-adic shift is recognizable. We provide examples of eventually recognizable, but not recognizable, sequences of morphisms, and sequences of morphisms which are not eventually recognizable. As an application, for a recognizable sequence of morphisms, we obtain an almost everywhere bijective correspondence between the S-adic shift it generates, and the measurable Bratteli-Vershik dynamical system that it defines. This is joint work with Valérie Berthé, Wolfgang Steiner and Jörg Thuswaldner.