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## Complete characterization of multiplication CA with respect to pre-expansivity

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In the context of Cellular Automata (CA), “pre-expansivity” is the property of being positively expansive on asymptotic pairs of configurations (i. e. configurations that differ in only finitely many positions). Pre-expansivity therefore lies between positive expansivity and pre-injectivity, two important notions of CA theory.

In this talk we consider the family of reversible one-way cellular automata that corresponds to multiplication by  $k$  in base  $m=kk'$ , where “directional” pre-expansivity can be completely characterized in terms of  $k$  and  $k'$ . This family was already considered by Blanchard-Maass, and positive left-expansivity was characterized in terms of  $k$  and  $k'$ , our result shows that these two notions are completely independent (orthogonal). On the other hand, the “directional” pre-expansive CA in this family coincide with the universal pattern generators of the family, i.e., CAs where every word is present somewhere in the positive orbit of every finite initial configuration.

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