DISCRETE BIFURCATION DIAGRAMS AND PERSISTENCE

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ABSTRACT

Given a cell complex M and a sequence of discrete Morse functions $F_{t_i} : M \to R$. Suppose that $0=t_0<t_1<t_2...<t_n=1$. Let $M \text{x} \{ti\} \subset M \text{x} I$ be a slice and V_i denote the discrete vector field on each slice. We would like to extend the discrete vector field on each slice to a discrete vector field on all of MxI. We aim to obtain a discrete bifurcation diagram by connecting critical cells of the slices. In "Birth and Death in Discrete Morse Theory" (King, Knudson, Mramor), a solution for finding the discrete bifurcation diagram has been presented. In this study, two cases have been checked. In the first case, triangulation of each slice is the same and MxI is regularly cell decomposed. There is a known algorithm to extend vector field on slice to a vector field on all of MxI. In the second case, we have a different triangulation on M. It has seen that the way to extend the vector field on each slice to a vector field on all of MxI is not obvious. In this case, we have to choose a cell structure for MxI compatible with slices. The algorithm how one could define a discrete vector field on the resulting cell complex which does not have any closed paths is not known.

We intent to find the method to define discrete vector field on cell complex so that the resulting vector field on MxI is a gradient vector field and use persistence diagrams for finding the discrete bifurcation diagrams and then make an application to test our method.

Keywords. Discrete Morse function, discrete bifurcation diagram, persistence homology.