

Examples of $\mathbf{CD}(0, N)$ spaces with non-constant dimension

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Abstract. In this work, we present some examples of $\mathbf{CD}(0, N)$ spaces having different topological and Hausdorff dimensions in different regions having positive measure, deducing, in particular, that the topological splitting may fail in $\mathbf{CD}(0, N)$ spaces. We also observe that any reasonable non-branching condition may fail in $\mathbf{CD}(0, N)$ spaces and that the existence of an optimal transport map between two absolutely continuous marginals is not guaranteed by the $\mathbf{CD}(0, N)$ condition, without requiring a non-branching assumption. Moreover, we show that the strict $\mathbf{CD}(0, N)$ condition is strictly stronger than the classical $\mathbf{CD}(0, N)$ one and that it is not stable with respect to the measured Gromov-Hausdorff convergence.

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