Random subgraphs make identification affordable

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An identifying code of a graph is a dominating set which uniquely determines all the vertices by their neighborhood within the code. Whereas graphs with large minimum degree have small domination number, this is not the case for the identifying code number (the size of a smallest identifying code), which indeed is not even a monotone parameter with respect to graph inclusion.

We show that for every graph G with n vertices, maximum degree $\Delta = \omega(1)$ and minimum degree $\delta \geq c \log \Delta$, for some constant $c > 0$, there exists a set of edges $F \subseteq E(G)$, $|F| = O(n \log \Delta)$, such that $G \setminus F$ admits an identifying code of size

$$O\left(\frac{n \log \Delta}{\delta}\right) .$$

In particular, if $\delta = \Theta(n)$, then G has a dense spanning subgraph with identifying code $O(\log n)$, namely, of asymptotically optimal size. The proof is non constructive. We consider a random subgraph of G where each edge is deleted with different probability and we use an interplay of various random methods to analyze it. Moreover, we show that the result is essentially best possible, both in terms of the number of deleted edges and the size of the identifying code.

This is joint work with Florent Foucaud and Oriol Serra.