Online Prediction on Large Diameter Graphs
Mark Herbster, Guy Lever, Massimiliano Pontil (University College London)

- Learn labelling of a graph online
- Mistake bounds:
  \[ M \leq f(\text{complexity}(u), \text{geometry}(G)) \]
- Limitation of Laplacian methods
- e.g. Min norm interpolation:

\[
\text{Mistake bound} = \Theta(\sqrt{|V|})
\]

- **Spine**: approximate structure-preserving embedding of any graph into a path

1-NN \(\equiv\) **Halving Algorithm** on \(S\)

\[
M = O\left(\phi_G(u) \log \left(\frac{|V|}{\phi_G(u)}\right)\right)
\]

Cumulative time to predict \(m\) labels
\[O(m \log m + |E|)\]

Second solution:
- Exploits cluster structure
- Exploits connectivity
- Logarithmic guarantee