January 23, 2023 - Slack (Rafael Bailo)

Assume still that the directional derivative $DE[u, v]$ (at the point u, in the direction of v) is given by $\int \partial E/\partial u \cdot v$

Then, the L2 gradient flow is $\partial_t u = -\partial E/\partial u$

This is true for any energy

And the first assumption it's not an assumption, it's the definition of the variation $\partial E/\partial u$

(We usually write $\delta E/\delta u$)

This was true for functions. Now, instead, we repeat the steps where the energy is a function of the point positions

The directional derivative DE[u,v] becomes a "total derivative"

The variation $\partial E/\partial u$ becomes the vector of partial derivatives

The integral inner product $\int \partial E/\partial u \cdot v$ becomes a sum inner product

It's all still true, except we're not in the function space L2, we're in the finite dimensional equivalent

And this finite dimensional equivalent happens to be R^{3M}, where M is the number of points