Quad-tree Generation with RNN for Efficient Graph Visualization

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With a huge amount data getting collected every day, visual analytics is getting more important to help the users understand their data. The CERN developed Collaboration Spotting is a tool providing generic infrastructure to visualize different types of data. To achieve this a multistep process is computing the visual maps of the available data, that involves community detection and visual graph organization. In the current work the emphasis is on graph organization with the ForceAtlas algorithm. This method is responsible to assign coordinates in a 2D space for every node in such a way that they will not overlap on each other. As this algorithm is an n-body simulation between the nodes, the Barnes-Hut algorithm is used to generate a quad-tree to reduce the complexity of the computation. It is notable for having order $\mathcal{O}(n \log n)$ compared to a direct-sum algorithm which would be $\mathcal{O}(n^2)$.

In a recurrent neural network (RNN) the connections between neurons form a directed graph along a sequence. This allows it to exhibit dynamic temporal behavior for a time sequence. RNNs can use their internal state (memory) to process sequences of inputs.

Using RNN in the quad-tree generation, we can predict the sum of mass of all the nodes in each region. The usage of an RNN with Long Short-Term Memory is explored, how it affects the precision and overall performance of the algorithm relying on the massively parallel performance of the GPUs.