Backbone Layout

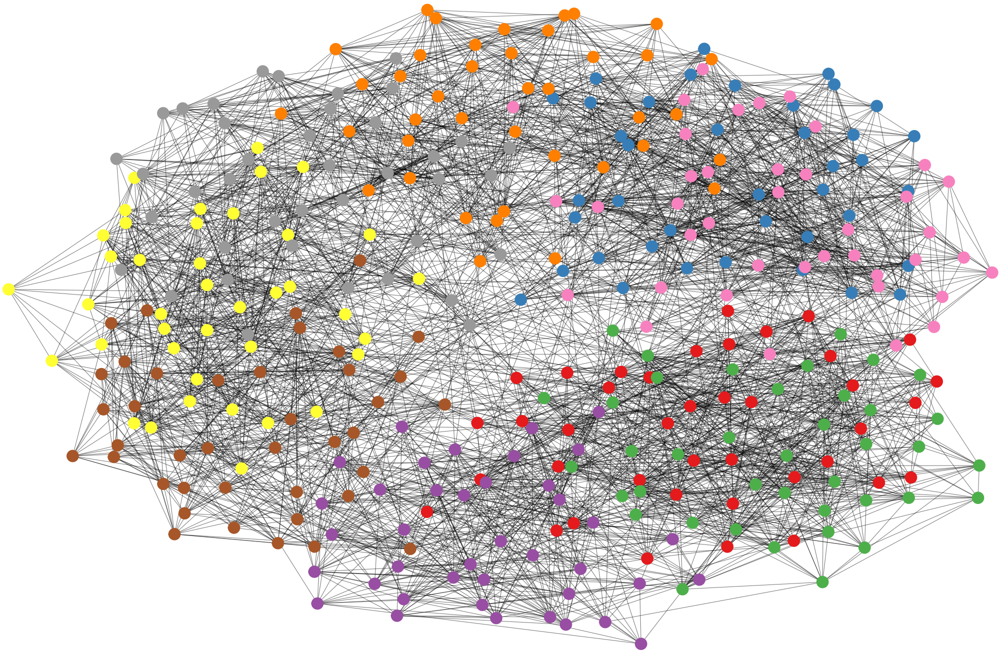
```
library(igraph)
library(graphlayouts)
library(ggraph)
```

`layout_as_backbone()` is a layout algorithm that can help emphasize hidden group structures if they exist. For illustration, we create a clustered network with the `sample_islands` function from igraph.

```
#create network with a group structure (9 groups, 40 vertices each)
g <- sample_islands(9,40,0.4,15)
g <- simplify(g)
V(g)$grp <- as.character(rep(1:9,each=40))
```

The network `g` consists of 9 groups with 40 vertices each. The density of each intra-group edges is 0.4 and there are 15 edges running between each pair of groups. Lets start using stress minimization as a layout algorithm.

```
ggraph(g,layout="stress")+
  geom_edge_link0(edge_colour=rgb(0,0,0,0.5),edge_width=0.1)+
  geom_node_point(aes(col=grp))+
  scale_color_brewer(palette = "Set1")+
  theme_graph()+
  theme(legend.position = "none")
```



As you see, we basically see nothing. The network seems very dense without any special structural features. Enter `layout_as_backbone()`.

```
bb <- layout_as_backbone(g,keep = 0.4)
E(g)$col <- F
E(g)$col[bb$backbone] <- T
```

The algorithm works as follows. First, it constructs a spanning tree (more precise the union of all maximum spanning trees). Second, it computes edge weights that capture the embeddedness of edges (technical details can be found in the paper). These weights are then ordered decreasingly. The top ranked nodes are then added to the tree and a layout of this "backbone" network is computed. The number of top ranked nodes added can be controlled with the keep parameter. In our example, the top 40% edges are added to the tree. Once the layout is calculated, all edges are addd back to the graph.

```
ggraph(g,layout="manual",node.positions=data.frame(x=bb$xy[,1],y=bb$xy[,2]))+
  geom_edge_link0(aes(edge_colour = col),edge_width=0.1)+
  geom_node_point(aes(colour = grp))+
  scale_color_brewer(palette = "Set1")+
  scale_edge_color_manual(values=c(rgb(0,0,0,0.3),rgb(0,0,0,1)))+
  theme_graph()+
  theme(legend.position = "none")
```