network *visualization*

introduction to *network science in Python* (*NetPy*)

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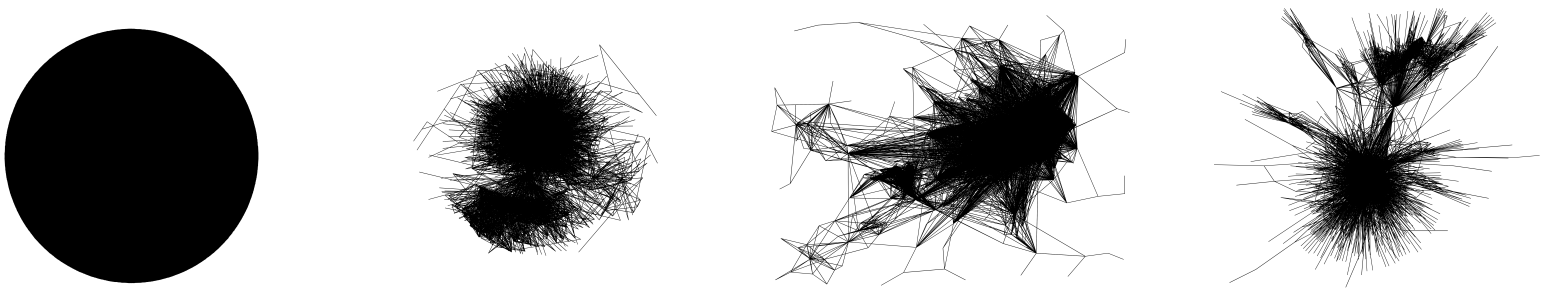
visualization *overview*

network *visualization* with *wiring diagram*

1st find *network layout* as node *coordinates* in Euclidean plane etc.

2nd *representation* of *network links*? strength, pattern, shape, color etc.

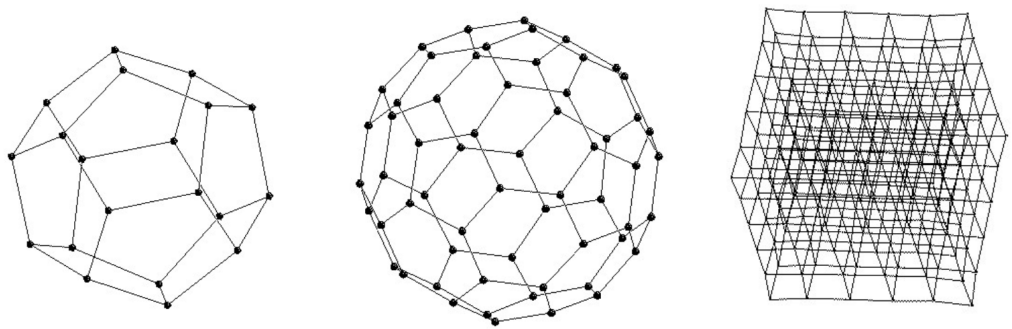
3rd *representation* of *network nodes*? size, shape, color, label etc.



similar link lengths, no crossings, displays symmetry, even node distribution etc.

visualization *Fruchterman-Reingold*

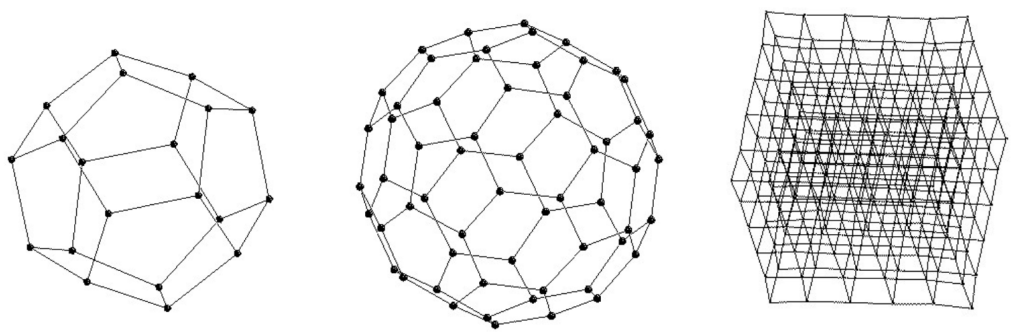
- Fruchterman-Reingold *force-directed layout* [FR91]
- move nodes thus to *minimize layout energy*
- *repulsive force* between *nodes* i and j is $\propto -c^2/l_{ij}$
- *attractive force* between *neighbors* i and j is $\propto l_{ij}^2/c$
  - l_{ij} is *Euclidean distance* between *nodes* i and j
  - c is *appropriate constant* set to $\propto \sqrt{area/n}$



pleasing with similar link lengths, symmetry & even distribution

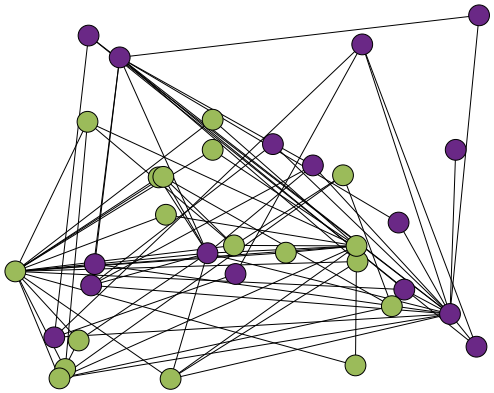
visualization *Kamada-Kawai*

- Kamada-Kawai *graph theoretic layout* [KK89]
- move nodes thus to *minimize layout energy* $l_{ij} \propto d_{ij}$
- *effective force* between *nodes* i and j is $\propto 1/d_{ij}^2$
  - l_{ij} is *Euclidean distance* between *nodes* i and j
  - d_{ij} is *geodesic distance* between *nodes* i and j

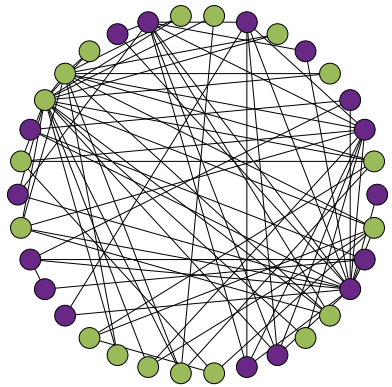


desired layout distance between nodes is their graph distance

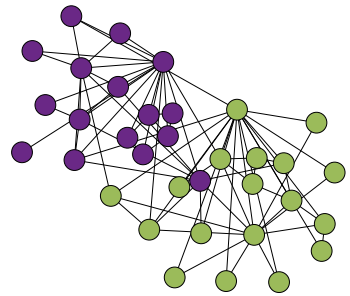
visualization *karate*



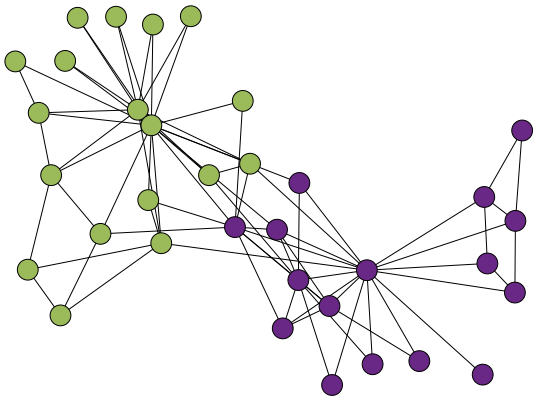
random layout



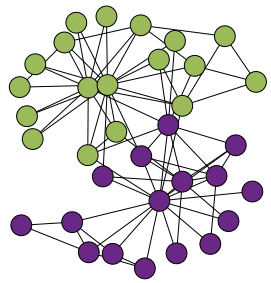
circular layout



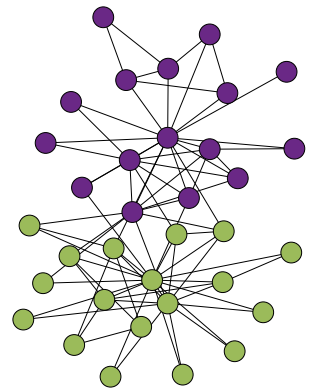
spring embedded layout [Ead84]



Fruchterman-Reingold layout [FR91]

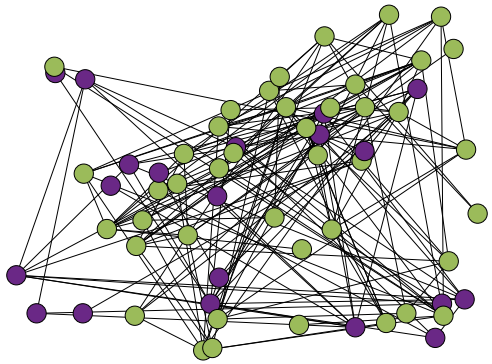


Kamada-Kawai layout [KK89]

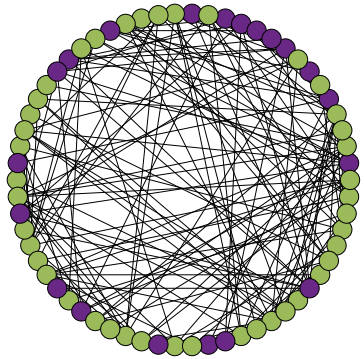


LGL layout [ADWM04]

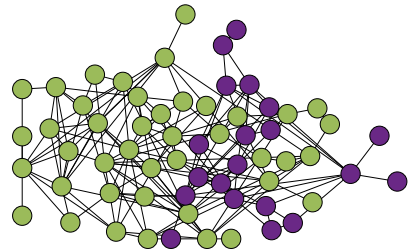
visualization *dolphins*



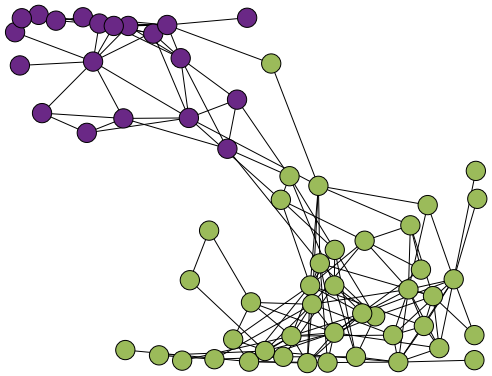
random layout



circular layout



spring embedded layout [Ead84]



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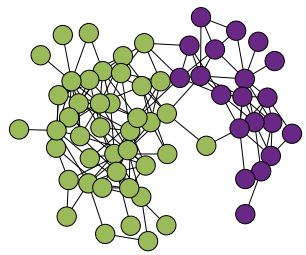
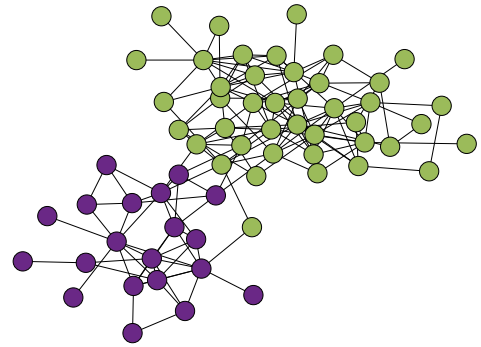
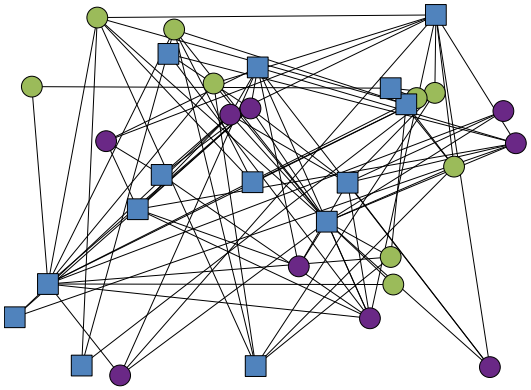


Kamada-Kawai layout [KK89]

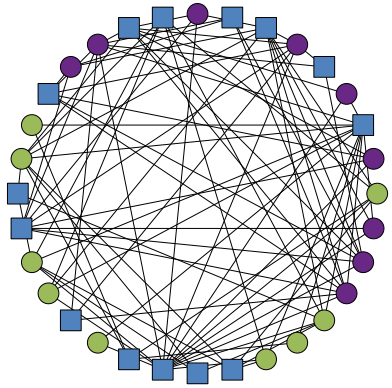


LGL layout [ADWM04]

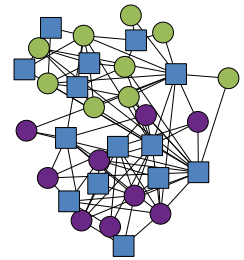
visualization *women*



random layout



circular layout



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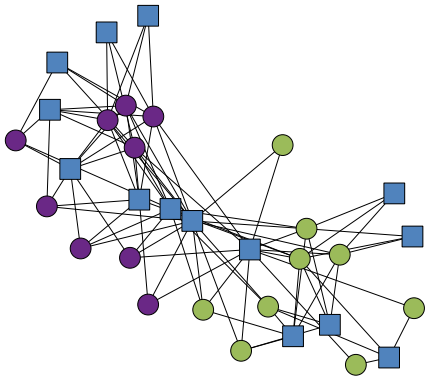

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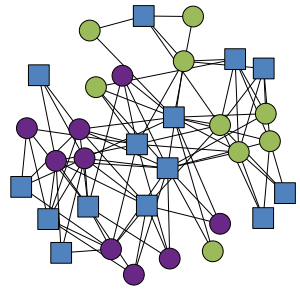

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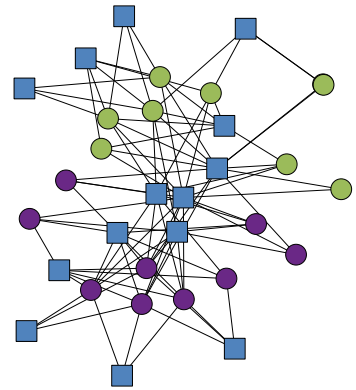

LGL layout [ADWM04]

visualization *references*

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