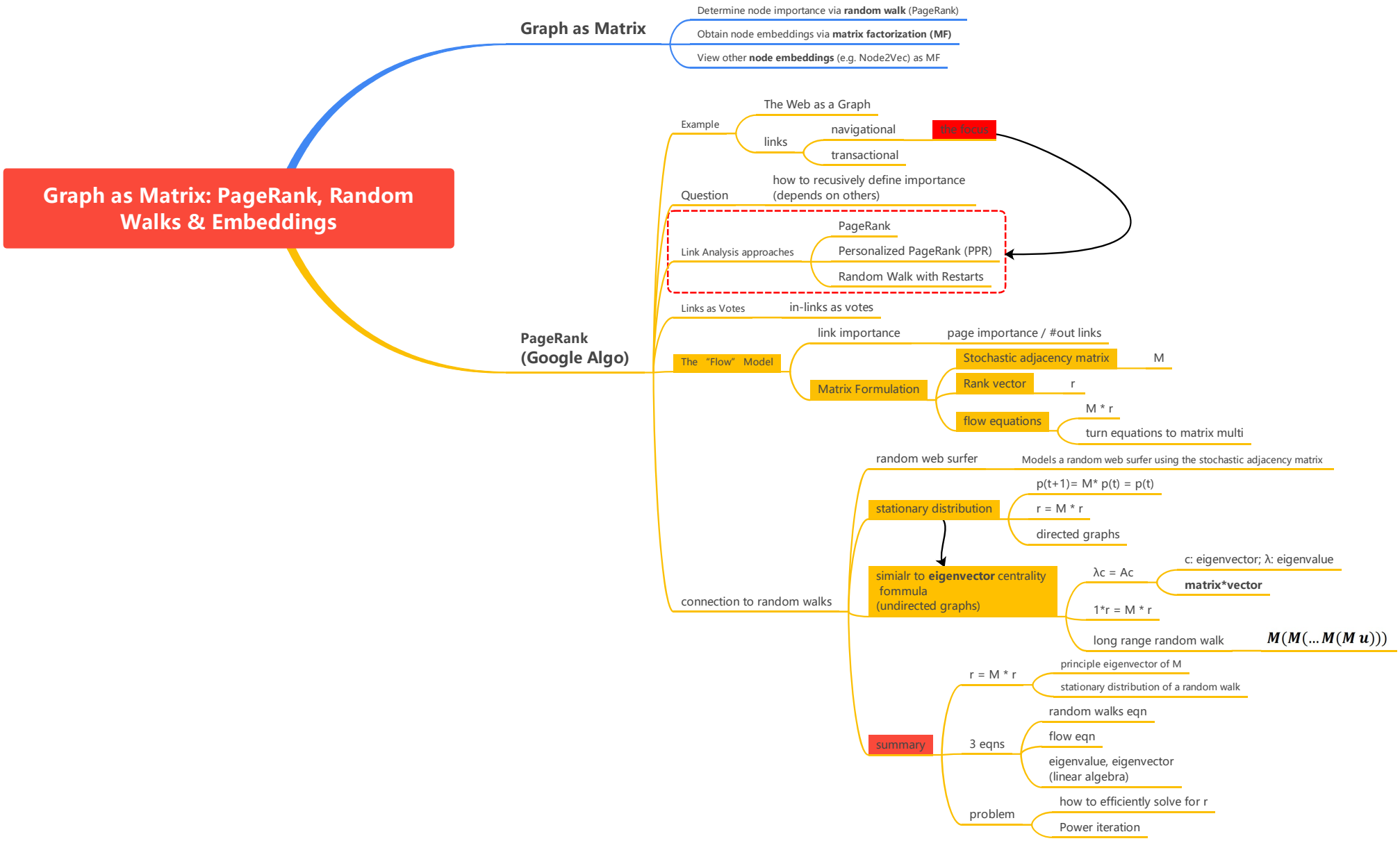
Graph as Matrix: PageRank, Random Walks & Embeddings
Graph as Matrix
Determine node importance via random walk (PageRank)
Obtain node embeddings via matrix factorization (MF)
View other node embeddings (e.g. Node2Vec) as MF
PageRank (Google Algo)
Example
The Web as a Graph
links
navigational
transactional
the focus
Question
how to recusively define importance (depends on others)
Link Analysis approaches
PageRank
Personalized PageRank (PPR)
Random Walk with Restarts
Links as Votes
in-links as votes
The "Flow" Model
link importance
page importance / #out links
Matrix Formulation
Stochastic adjacency matrix
M
Rank vector
r
flow equations
M * r
turn equations to matrix multi
connection to random walks
random web surfer
Models a random web surfer using the stochastic adjacency matrix
stationary distribution
p(t+1)= M* p(t) = p(t)
r = M * r
directed graphs
simialr to eigenvector centrality fommula (undirected graphs)
λc = Ac
c: eigenvector; λ: eigenvalue
matrix*vector
1*r = M * r
long range random walk
$M(M(...M(Mu)))$
summary
r = M * r
principle eigenvector of M
stationary distribution of a random walk
3 eqns
random walks eqn
flow eqn
eigenvalue, eigenvector (linear algebra)
problem
how to efficiently solve for r
Power iteration