Propagation of Trust and Distrust

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Motivation

- Far too many things - webpages, products, postings, etc
- We can leverage other people's opinions
- Avoid disinformation
  - search engine spam
  - shilling
  - practical jokes

Avoiding Disinformation

- Some opinions can be trusted, some cannot
- Sparsity problem - most people know nothing about most other people
- Who you distrust can be more important than who you do trust
  - Usually the majority will be trustworthy

Atomic Operations

- Matrix B is either trust or trust/distrust combo
- Direct Propagation - B x B
  - if i -> j and j -> k, then i -> k
- Co-citattion - B x B' x B (B' is transpose of B)
  - if i -> j, i -> k, m -> j, then m -> k
- Transpose Trust - B x B'
  - if i -> j, then j -> i
- Trust Coupling - B x B x B'
  - if i -> j, k -> j, m -> i, then m -> k

Propagation

- Only Direct vs. only co-citation vs combination
- Two ways to iterate
  - Eigenvalue Propagation
    - Use single result from many iterations
  - Weighted Linear Combination
    - Use sum of results from each iteration, with greater weight given to fewer iterations

Iteration	α	Propagation	Global round.		Local round.		Maj. round.	
			ϵ	ϵ_S	ϵ	ϵ_S	ϵ	ϵ_S
EIG	e_1	Trust only	0.153	0.500	0.123	0.399	0.077	0.175
		One-step distrust	0.119	0.251	0.108	0.223	0.067	0.162
		Prop. distrust	0.365	0.452	0.368	0.430	0.084	0.206
	e_2	Trust only	0.153	0.500	0.114	0.365	0.080	0.190
		One-step distrust	0.097	0.259	0.087	0.234	0.066	0.159
		Prop. distrust	0.149	0.380	0.121	0.279	0.080	0.187
	e^*	Trust only	0.153	0.500	0.107	0.336	0.077	0.180
		One-step distrust	0.096	0.253	0.086	0.220	0.064	0.147
		Prop. distrust	0.110	0.284	0.101	0.238	0.079	0.180
WLC, $\gamma = 0.5$	e_1	Trust only	0.153	0.500	0.123	0.390	0.189	0.163
		One-step distrust	0.093	0.231	0.083	0.205	0.098	0.205
		Prop. distrust	0.102	0.221	0.098	0.199	0.121	0.295
	e_2	Trust only	0.153	0.500	0.113	0.354	0.074	0.174
		One-step distrust	0.088	0.254	0.080	0.231	0.093	0.187
		Prop. distrust	0.126	0.336	0.100	0.252	0.076	0.177
	e^*	Trust only	0.153	0.500	0.108	0.340	0.078	0.159
		One-step distrust	0.086	0.247	0.076	0.217	0.092	0.190
		Prop. distrust	0.087	0.237	0.079	0.203	0.074	0.162
WLC, $\gamma = 0.9$	e_1	Trust only	0.153	0.500	0.123	0.391	0.132	0.152
		One-step distrust	0.102	0.241	0.092	0.216	0.069	0.171
		Prop. distrust	0.111	0.238	0.106	0.211	0.101	0.227
	e_2	Trust only	0.153	0.500	0.113	0.356	0.078	0.184
		One-step distrust	0.092	0.260	0.082	0.235	0.071	0.173
		Prop. distrust	0.134	0.355	0.106	0.261	0.078	0.188
	e^*	Trust only	0.153	0.500	0.107	0.337	0.075	0.169
		One-step distrust	0.091	0.253	0.082	0.222	0.072	0.171
		Prop. distrust	0.091	0.254	0.081	0.209	0.078	0.177

Table 3: Prediction of various algorithms. Here, $e^* = (0.4, 0.4, 0.1, 0.1)$, $K = 20$.

Conclusions

- Each atomic operation is useful for prediction
- Adding one-step distrust is almost always useful
- Adding many-iteration distrust can be effective
  - Does i -/-> j and j -/-> k imply i -/-> k or i -> k ?
- Iteration methods are roughly equivalent
- Majority rounding is most effective