Large-Scale Collection Threading using Structured k-DPPs

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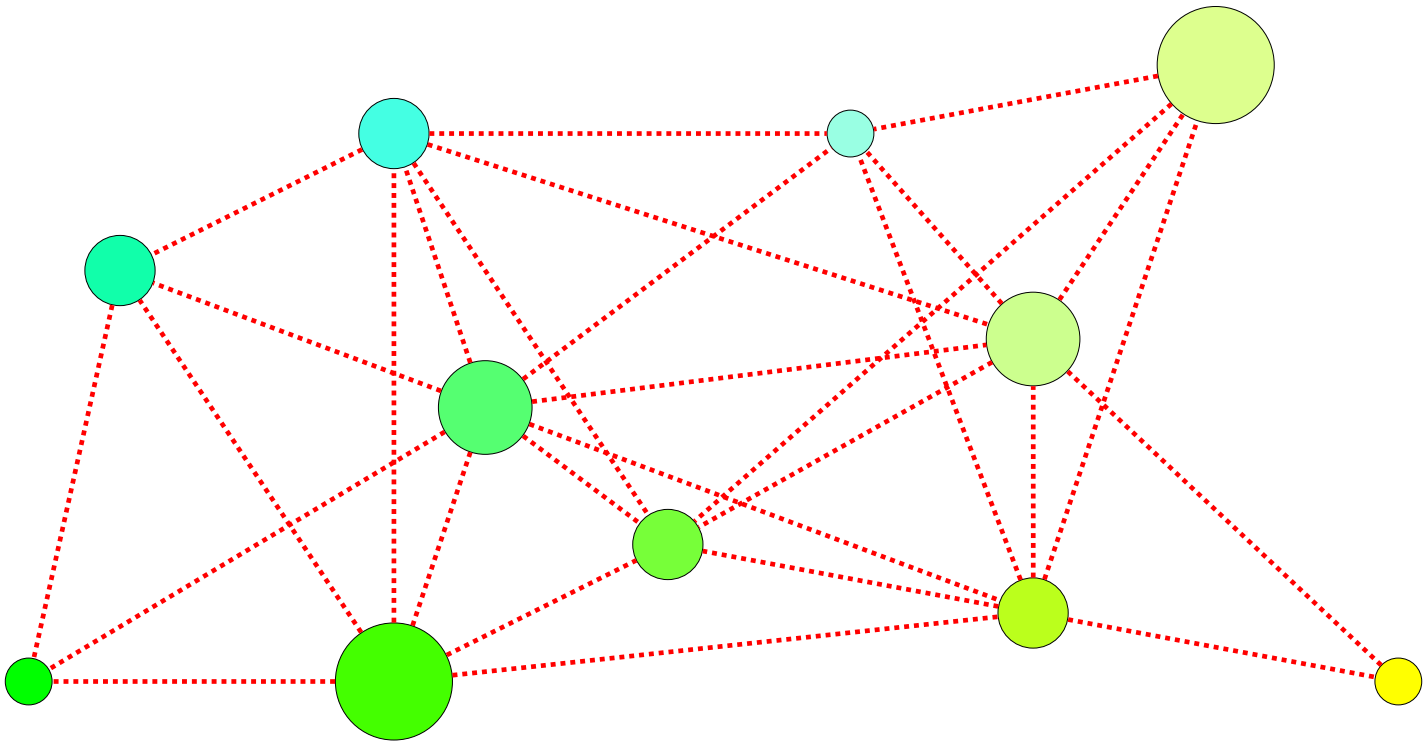
Novel task definition

Select a *high-quality set of diverse paths* in a data graph



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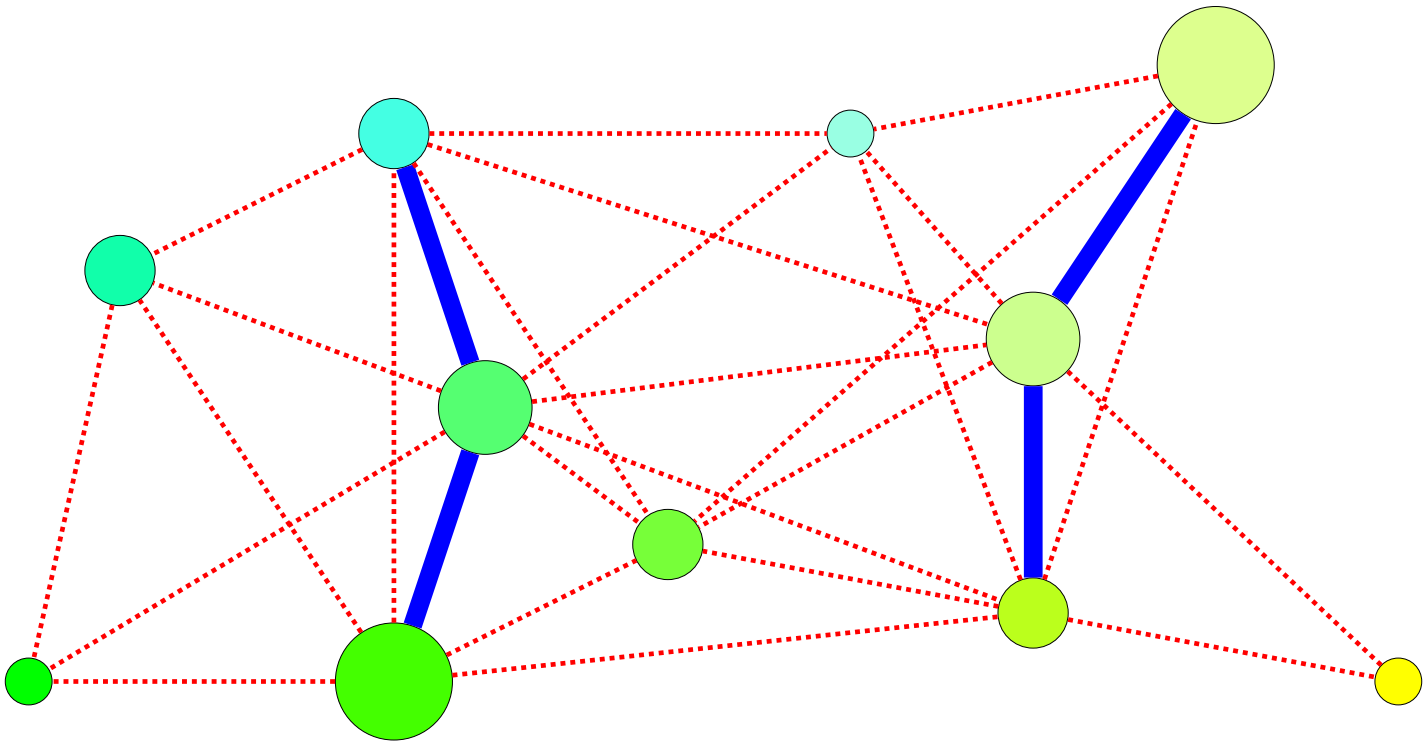
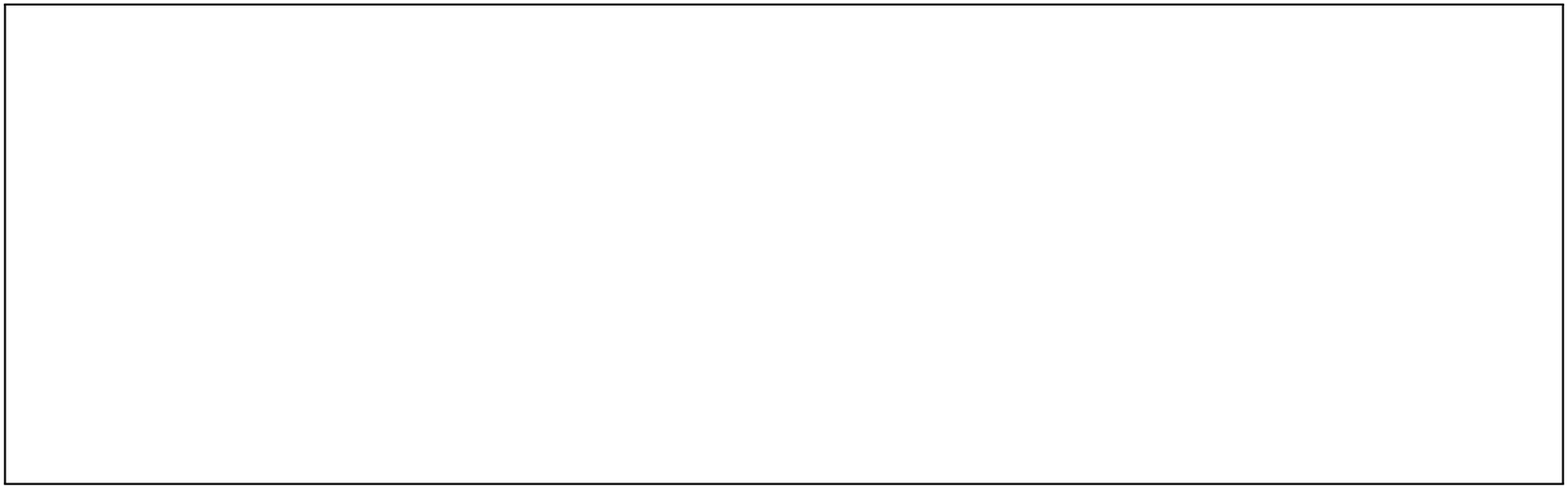


News Timeline



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May 18:	Pope Sends Message with Choice of Name

Related threading work

- Selecting a *single* thread (D. Shahaf and C. Guestrin, KDD 2010)

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- Building diverse *topic* threads (A. Ahmed and E. Xing, UAI 2010)

Approach: Structured Determinantal Point Processes

Score a set of threads **Y** via structured determinantal point process (SDPP)[1]

[1] (A. Kulesza and B. Taskar, NIPS 2010)

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$$\mathbf{L_{ij}} = \mathbf{q(y_i)}\phi\mathbf{(y_i)}^\top\phi\mathbf{(y_j)q(y_j)}$$

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Approach: Structured Determinantal Point Processes

k-SDPPs[1]: fix # of points in **Y** to **k**

[1](A. Kulesza and B. Taskar, ICML 2011)

Sampling from **k**-SDPPs

$$\mathbf{O(TrnD^2 + D^3)}$$

$\mathbf{T}$ = thread length

$\mathbf{r}$ = maximum node degree

$\mathbf{n}$ = # of nodes

$\mathbf{D}$ = # of features

Random Projection for Tractability

- Project **D** down to **d**

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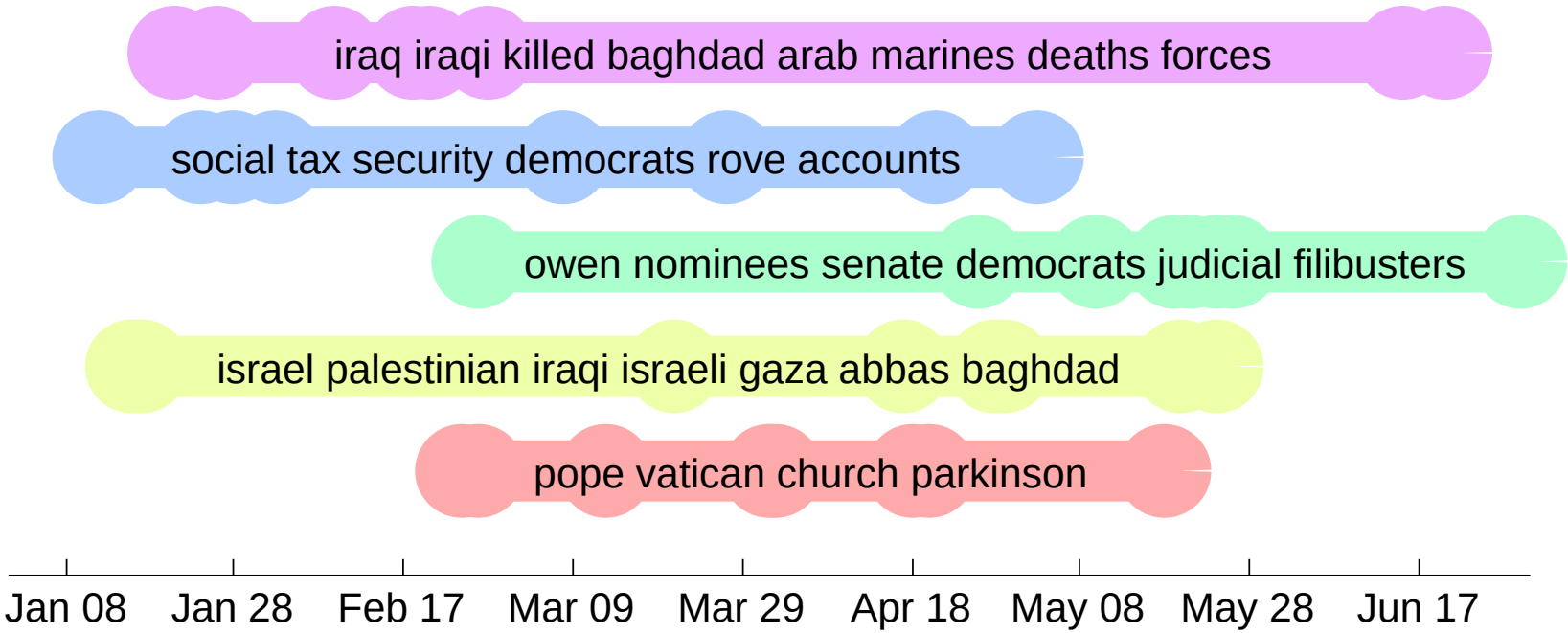
- **Theorem**: Given $\tilde{\mathbf{P}}^{\mathbf{k}}(\mathbf{Y})$ = distribution after projecting

$$\|\mathbf{P}^{\mathbf{k}} - \tilde{\mathbf{P}}^{\mathbf{k}}\|_{\mathbf{1}} \leq \text{nice small things}$$

New York Times Timelines



New York Times Timelines

k-means DTM **k**-SDPP		

New York Times Timelines

	Human summary similarity	
k-means	4.32	
DTM	3.78	
k-SDPP	**8.26**	

New York Times Timelines

	Human summary similarity	Runtime (sec)
k-means	4.32	625
DTM	3.78	19,443
k-SDPP	**8.26**	**252**