Recommendation of content to mitigate the echo chamber effect

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Contribution

Goal: mitigate the echo chamber effect.

Objective metric: content diversity on newsfeeds.

Method: content recommendation.

Application: political Twitter dataset.

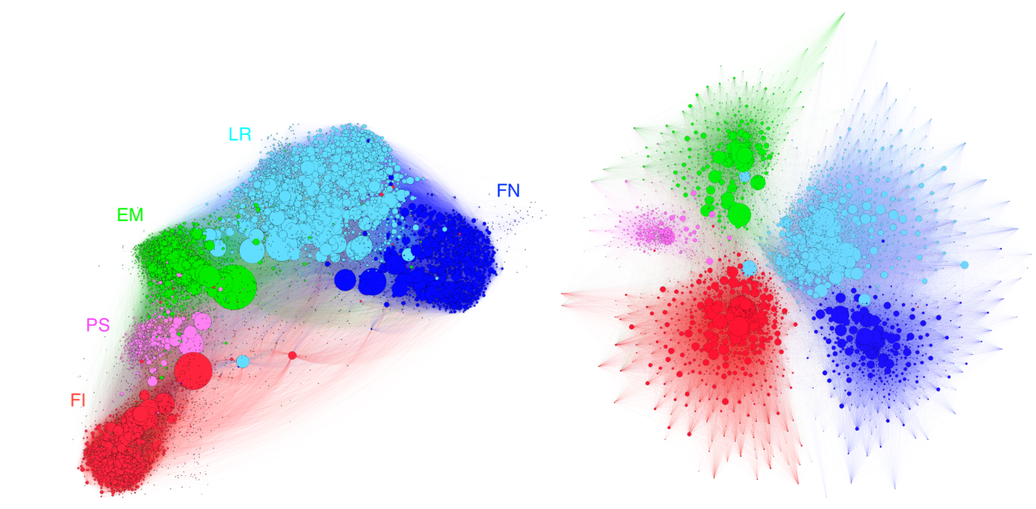
Result: significant improvement in content diversity.

Side product: extension of an existing diffusion model to describe opinion dynamics.

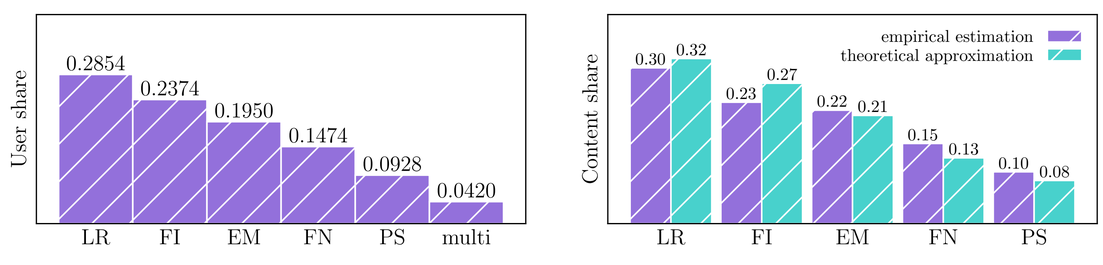
#Elysee2017fr dataset

Twitter dataset re. 2017 French presidential elections.

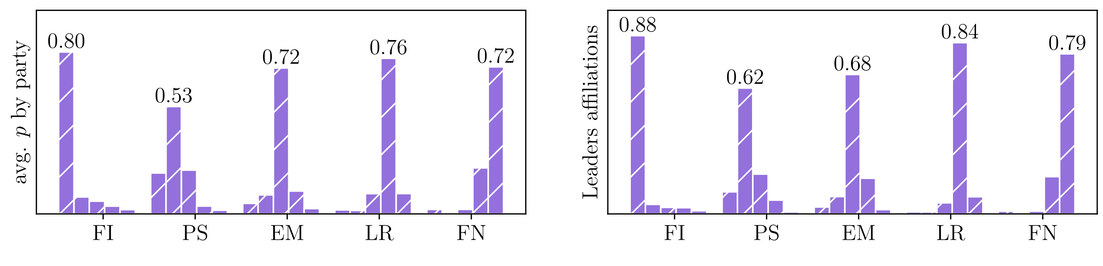
- 10 million tweets.
- $N = 8,277$ users, $975K$ edges.
- $S = 5$ parties.
- Political affiliations of users: FI, PS, EM, LR, FN.



Follow (left) and Retweet (right) graph.



Share of users and content for each party.



Echo chambers and homophily.

Model framework

- Strongly connected network of N users.
- User n creates posts supporting party s at rate $\lambda_s^{(n)}$.
- User n reposts from their newsfeed at rate $\mu^{(n)}$.

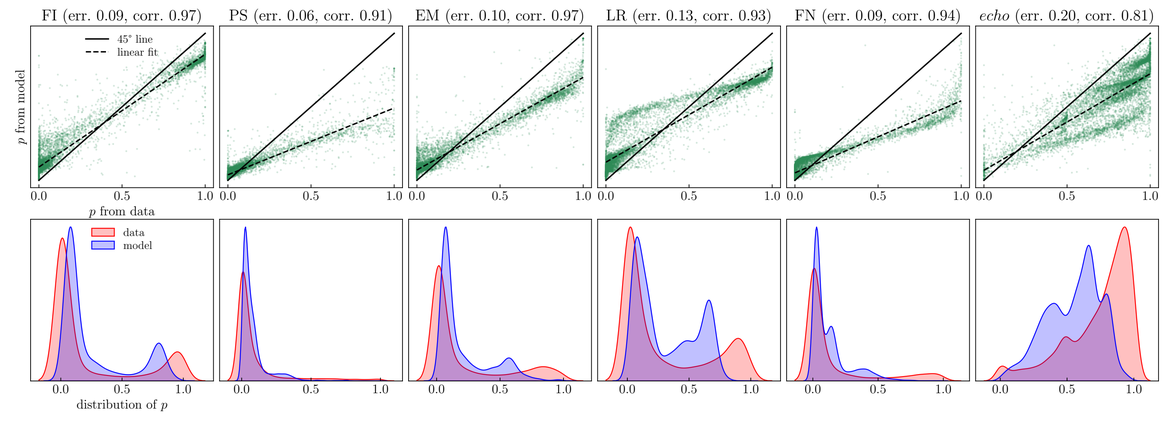
Balance of opinions on newsfeeds

$$p_s^{(n)} \sum_{k \in \mathcal{L}^{(n)}} (\lambda^{(k)} + \mu^{(k)}) = \sum_{k \in \mathcal{L}^{(n)}} (\lambda_s^{(k)} + \mu^{(k)} p_s^{(k)}). \quad (1)$$

Content diversity

$$\Phi_n = \frac{S}{S-1} \sum_{s=1}^{S} p_s^{(n)} (1 - p_s^{(n)}). \quad (2)$$

$p_s^{(n)}$: avg. prop. of content from party s on the newsfeed of n.



Empirical estimates of p versus theoretical values.

Optimisation

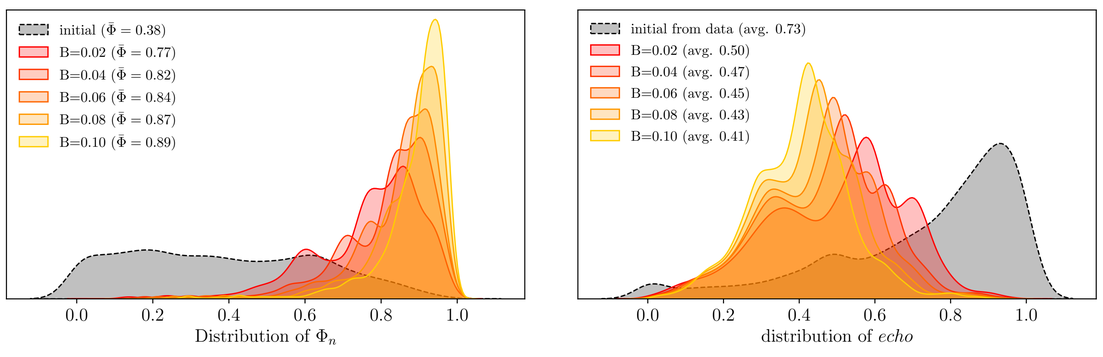
$$\underset{x,p}{\text{argmax}} \quad \frac{1}{N} \sum_n \Phi_n$$

$$\text{s.t.} \quad \text{for all } n, s:$$

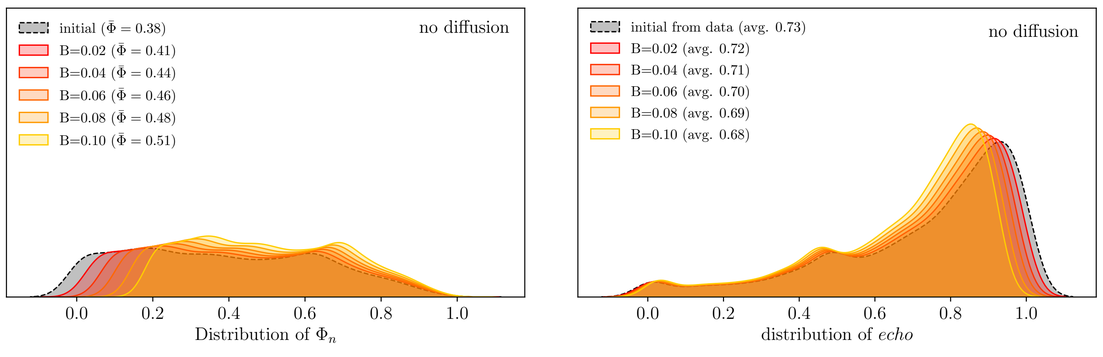
$$\underbrace{\frac{p_s^{(n)}}{1-B} \sum_{k \in \mathcal{L}^{(n)}} (\lambda^{(k)} + \mu^{(k)}) = x_s^{(n)} + \sum_{k \in \mathcal{L}^{(n)}} (\lambda_s^{(k)} + \mu^{(k)} p_s^{(k)})}_{\textit{model equation}},$$

$$\underbrace{\sum_s x_s^{(n)} = \frac{B}{1-B} \sum_{k \in \mathcal{L}^{(n)}} (\lambda^{(k)} + \mu^{(k)})}_{\textit{budget constraint}},$$

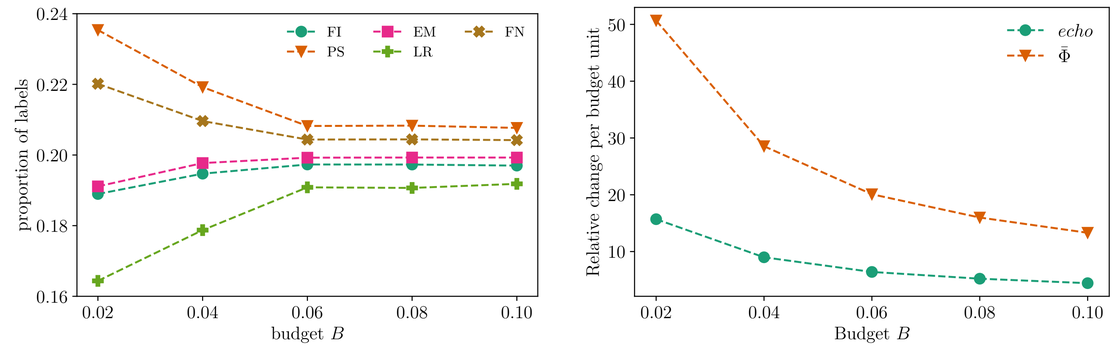
$$x_s^{(n)}, p_s^{(n)} \geq 0.$$



Left: *Increase of diversity for various budgets.* **Right:** *decrease of exposure to like-minded content.*



Same but without diffusion.



Left: *proportion of content circulating through the network for each party.* **Right:** *impact of each budget unit.*

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