Learning Triadic Influence in Large Social Networks

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Triadic Influence Analysis

- ## Social influence from the structural level
  - Triad is the simplest group structure in networks.

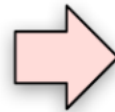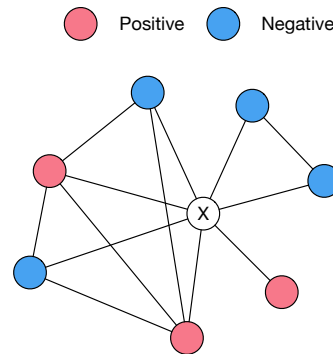- ## Behavior Prediction
  - What role the triadic structures among one's friends play in influencing her behavior?
 - Datasets: *Retweeting* on Weibo, *Paying* on CrossFire

Triadic Influence Patterns

- OLS analysis on different feature variables
  - Basic Features---Extracted from user profiles
  - Neighborhood Features---Number of positive (or negative) friends with strong (or weak) relationships
  - Triadic Features---Number of 30 triadic influence patterns with the label information and the strength of relationships
- Regression coefficients on Weibo dataset

REGRESSION ANALYSIS FOR NEIGHBORHOOD FEATURES

	Edge	B+E	B+E+Triads
#PosStrong	0.0840*** (0.002)	0.0544*** (0.002)	0.0602*** (0.006)
#PosWeak	0.1268*** (0.003)	0.0700*** (0.002)	0.0679*** (0.012)
#NegStrong	0.0355*** (0.001)	0.1670*** (0.002)	0.0490*** (0.009)
#NegWeak	-0.0490*** (0.001)	-0.0040** (0.002)	0.0201 (0.023)
R^2	0.041	0.242	0.301

REGRESSION ANALYSIS FOR 30 KINDS OF TRIADS

No.	Triad	Coef	No.	Triad	Coef	No.	Triad	Coef	No.	Triad	Coef	No.	Triad	Coef
1		0.0827*** (0.003)	2		0.0110*** (0.004)	3		-0.0543*** (0.003)	4		0.0004 (0.004)	5		0.0429*** (0.003)
6		-0.0587*** (0.003)	7		0.0205*** (0.002)	8		0.0313*** (0.002)	9		-0.0283*** (0.003)	10		0.0168*** (0.002)
11		-0.0091*** (0.002)	12		0.0861*** (0.004)	13		-0.0563*** (0.001)	14		-0.0221*** (0.002)	15		0.0157*** (0.003)
16		0.0167*** (0.003)	17		0.0164*** (0.003)	18		-0.0184* (0.010)	19		-0.0263*** (0.002)	20		0.0066*** (0.002)
21		-0.0001 (0.002)	22		0.0099*** (0.002)	23		0.0534*** (0.002)	24		-0.0054** (0.002)	25		0.0089*** (0.001)
26		-0.0783*** (0.002)	27		0.0818*** (0.002)	28		0.0130*** (0.002)	29		0.0494*** (0.002)	30		-0.0772*** (0.003)

- Although Neighborhood features are included in the model, most of the triadic influence patterns are significant.

- Most of the open triads result in negative coefficients even when the neighbors are positive (triad 3, 6, 9).

- The strength of relationship plays an important role in influencing one's behavior, but it is not necessarily positively correlated.

Triadic Patterns in Behavior Prediction

- Logistic regression as classifier
  - LRC-B/LRC-N/LRC-T: Logistic regression classifier with only Basic/Neighborhood/Triadic features
  - LRC-BN: Logistic regression classifier with Basic and Neighborhood features
  - LRC-BNT: Logistic regression classifier with all of the three features

PERFORMANCE OF BEHAVIOR PREDICTION ON TWO DATASETS. (%)

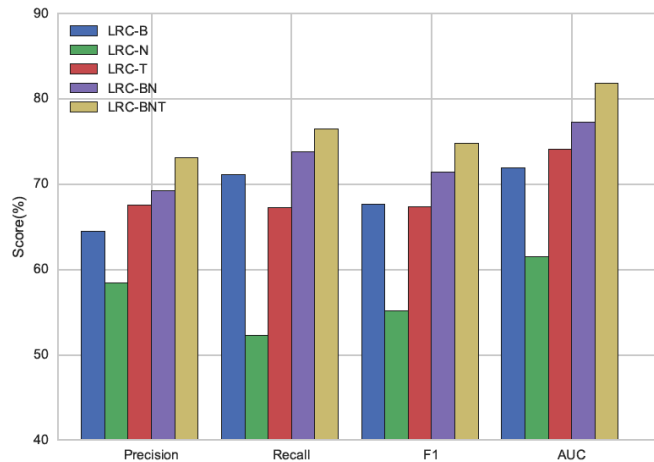| Dataset	Model	Precision	Recall	F1	AUC
Weibo	LRC-B	64.54	71.19	67.70	71.90
	LRC-N	58.46	52.27	55.19	61.53
	LRC-T	67.59	67.25	67.42	74.09
	LRC-BN	69.27	73.83	71.47	77.31
	LRC-BNT	**73.16**	**76.46**	**74.78**	**81.85**
CrossFire	LRC-B	69.63	**72.27**	70.92	77.62
	LRC-N	71.35	57.06	63.41	72.64
	LRC-T	71.52	58.85	64.57	73.56
	LRC-BN	71.37	70.27	70.81	78.35
	LRC-BNT	**71.53**	71.02	**71.27**	**78.76**

Triadic Patterns in Behavior Prediction

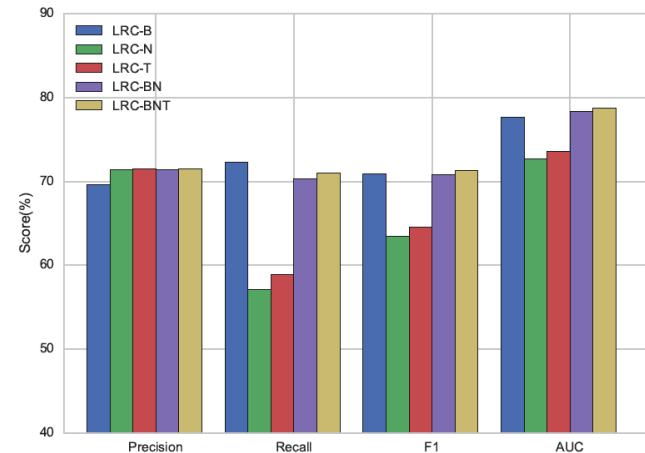Fig. 4. Performance of retweeting behavior prediction in Weibo

Fig. 5. Performance of buying behavior prediction in CrossFire

- Triadic features alone is almost as good as combining Basic and Neighborhood features.
- Triadic features can further improve the performance when augmented to LRC-BN.

Conclusions

- Classify triadic influence patterns

- Verify the existence of different triadic influence by OLS analysis

- Competitive performance in behavior prediction by leveraging the triadic influence