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# **A Trust Model Stemmed from the Diffusion Theory for Opinion Evaluation**

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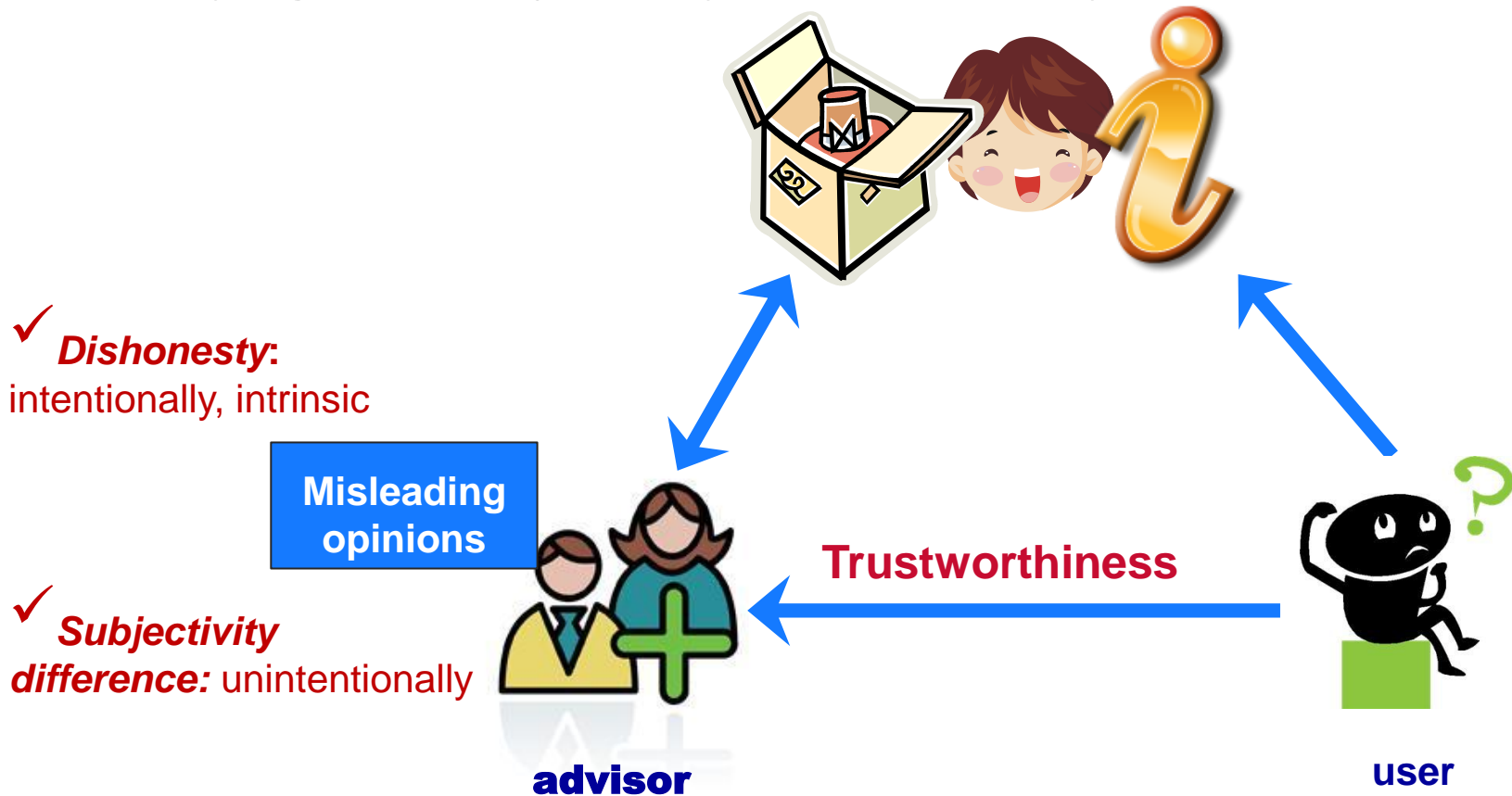
*Sep 26, 2013 on PhD Seminar*

# Outline

- 1 • Research Problem
- 2 • Related Work
- 3 • The Trust Model
- 4 • Empirical Evaluation
- 5 • Conclusion & Future Work

# Research Problem

- ❑ **PhD Topic:** Trust Modeling for Opinion Evaluation by Coping with Subjectivity and Dishonesty



# Research Objective

- Two goals:
  - Model the reputation of entities
  - Address advisor dishonesty and subjectivity

# Research Progress

- SARC: consider subjectivity for reputation computation

Hui Fang, Jie Zhang, Murat Sensoy and Nadia Magnenat Thalmann, "SRAC: subjectivity alignment for reputation computation", In Proceedings of the 11th International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2012
- **The DiffTrust Model** for modeling trustworthiness of advisors:  
**do not distinguish subjectivity and dishonesty**

Hui Fang, Jie Zhang and Nadia Magnenat Thalmann, "A Trust Model Stemmed from the Diffusion Theory for Opinion Evaluation", In Proceedings of the 12th International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2013
- Probabilistic Graphical Trust Model: distinguish both subjectivity and dishonesty

Hui Fang, Yang Bao and Jie Zhang, "Misleading Opinions Provided by Advisors: Dishonesty or Subjectivity", in Proceedings of the 23rd International Joint Conference on Artificial Intelligence (IJCAI), 2013

# Related Work

## □ Trust model based on shared interactions

### ➤ TRAVOS

- **Ineffective** when few shared interactions

### ➤ Personalized approach

- Public reputation of advisor
- Limitation: **equally treat other advisors' opinions**

# Related Work

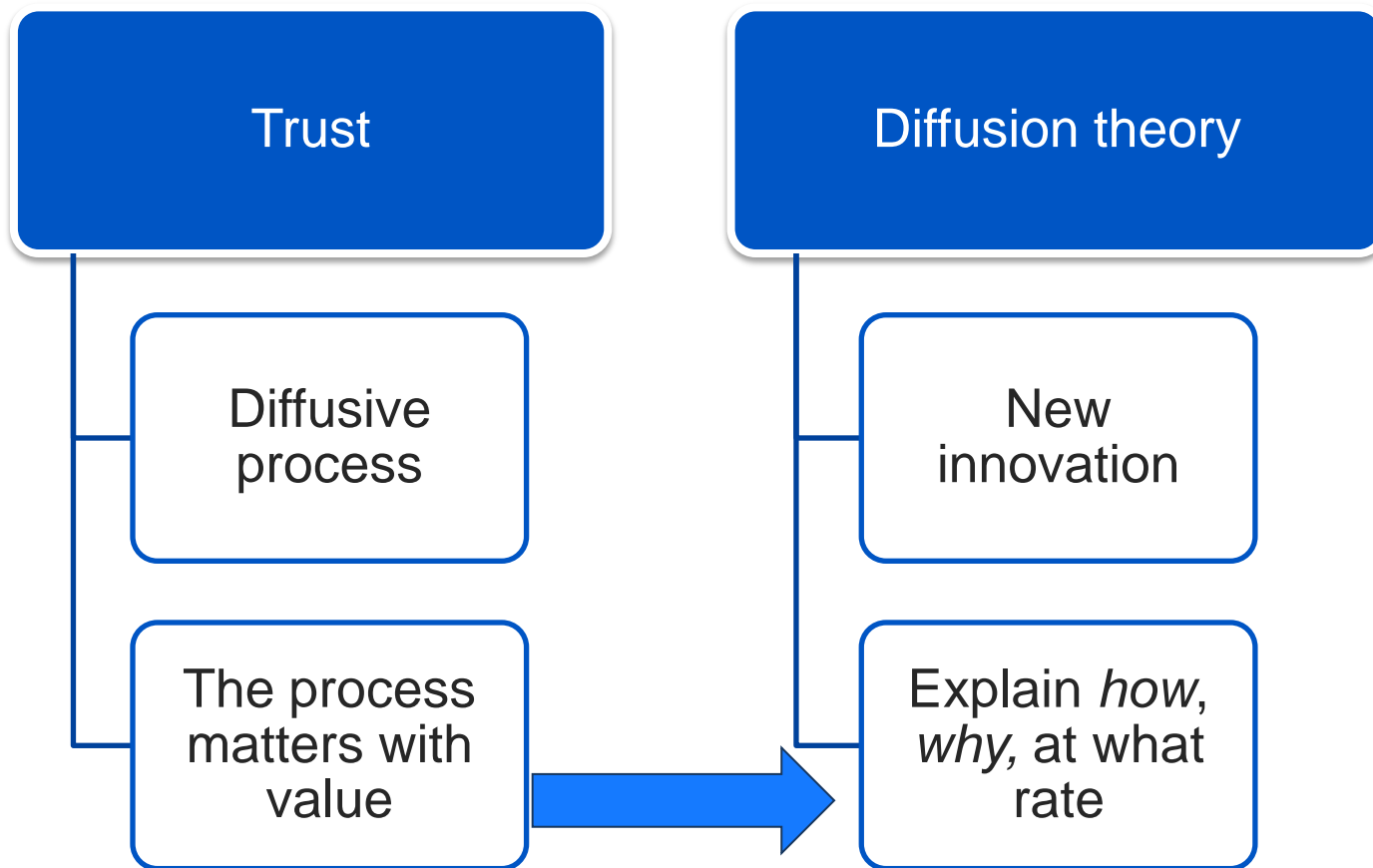
- Trust propagation
  - Ground on trust transitivity theory
  - Limitation: **unreachable witness problem**
  - **Shin**: address unreachable witness
    - Inaccurate evaluation towards reachable witness

# Our Trust Model

- Our trust model on diffusion theory: diffTrust
  - Use **social proximity** to consider indirect experience
    - Stemmed from Diffusion theory



# Why Diffusion Theory?



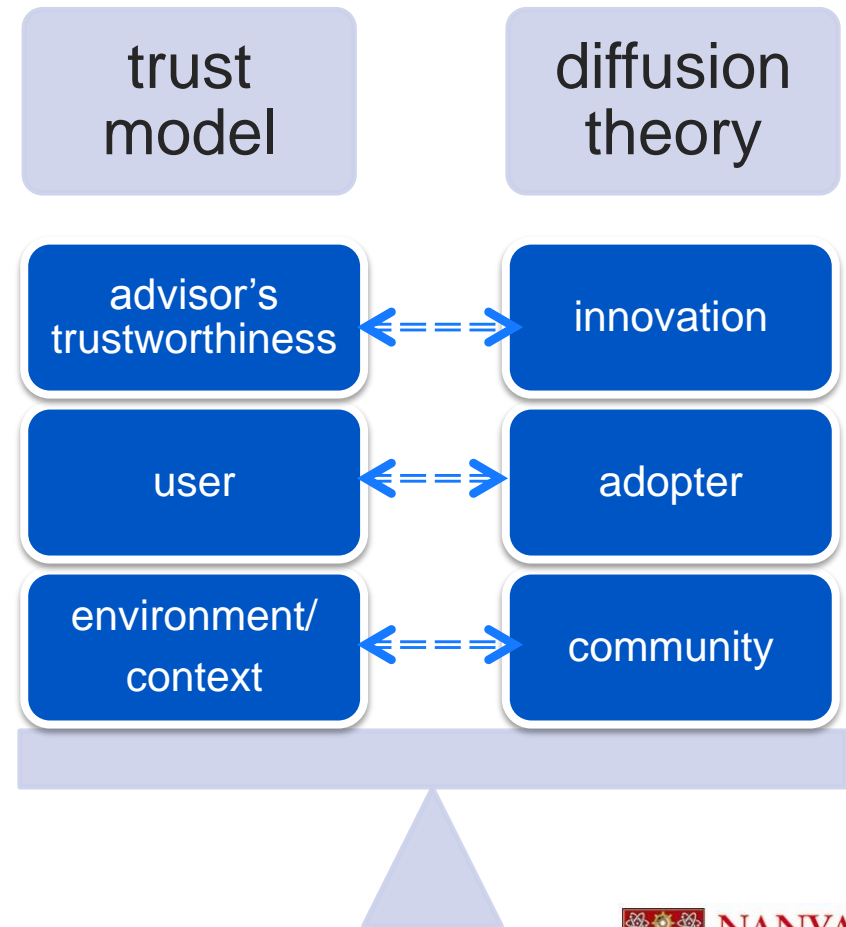
# Concept Mapping

## □ Similarity

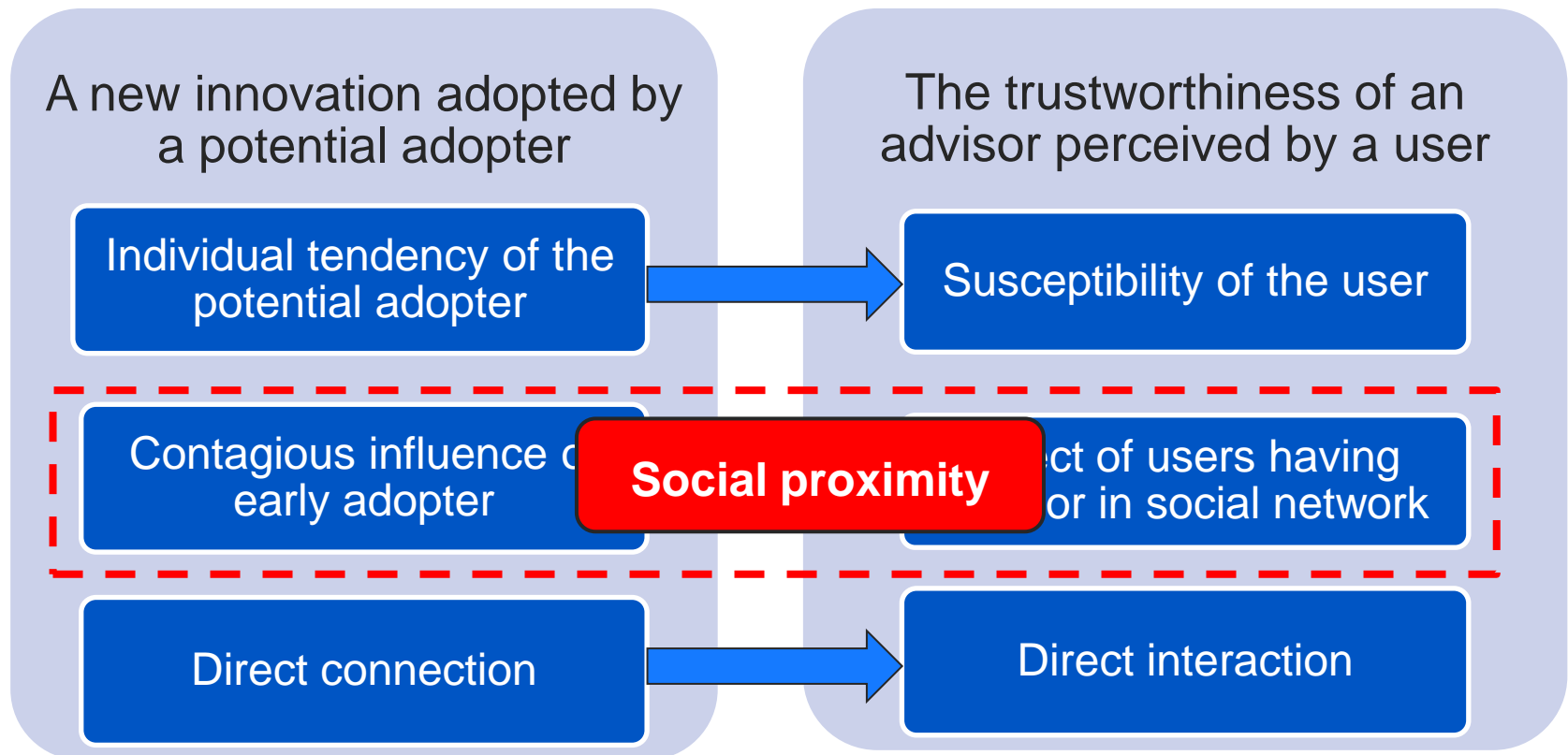
- Dynamic and evolutionary
- Subject to perceiving user
- Dependent on the environment

## □ Strang & Tuma 1993

- Individual-oriented heterogeneous diffusion model



# Model Components



# Social Proximity

## □ **Social proximity** computation

### ➤ Physically spatial information

- E.g. physical location and identity

### ➤ Socially spatial information

- E.g. position in the social network, and neighborhood
- Metrics: e.g. the number of common neighbors (CN), Jaccard coefficient or Adamic-Adar score

$$CN = \frac{1}{2} (|\Delta| + |\Delta'|)$$

$$\Delta = \Gamma_{out}(u) \cap \Gamma_{in}(v) \quad \Delta' = \Gamma_{in}(u) \cap \Gamma_{out}(v)$$

# Empirical Evaluation

## □ Data sets

Datasets	eBay	FilmTrust	Flixster	Epinions
Nodes in social network	5,531	1,508	1,000	23,848
Rating scale	-1, 0, 1	0.5-4	0.5-5	1-5
Trust between users	-	1	1	1
Ratio of having shared interactions	7.5%	81.9%	1.5%	21.8%

# Experimental Setting

## □ Metrics

- MCC: suitable for eBay dataset

$$MCC = \frac{t_p t_n - f_p f_n}{\sqrt{(t_p + f_p)(t_p + f_n)(t_n + f_p)(t_n + f_n)}}$$

- Precision

- MAE

## □ Benchmark comparison

- Baseline, TRAVOS, Personalized, CertProp, and Shin

# Results on eBay Dataset

- ❑ Skewed dataset, over 99% positive transactions
- ❑ Few shared interactions

eBay Dataset	All data		Cold start buyers ( $N_e \leq 2$ )		Sellers non-consistently perform ( $R_n \geq 0.1$ )	
	MCC	MAE	MCC	MAE	MCC	MAE
DiffTrust	0.327	0.0648	0.0007734	0.0769	0.5479	0.3010
Baseline	0.166	0.0708	-0.001773	0.0819	0.3229	0.3664
TRAVOS	0.156	0.0710	-0.002861	0.0817	0.3121	0.3679
Personalized	0.161	0.0710	-0.002861	0.0817	0.3270	0.3656
CertProp	0.270	0.0673	-0.002453	0.0812	0.4932	0.3225
Shin	0.269	0.0670	-0.002453	0.0813	0.4932	0.3225

# Results

- w.r.t. shared interactions: Filmtrust > Epinions > Flixster

Dataset	FilmTrust		Epinions		Flixster	
	Precision	MAE	Precision	MAE	Precision	MAE
DiffTrust	0.867	0.1154	0.8163	0.2064	0.6616	0.3229
Baseline	0.711	0.2136	0.6365	0.3428	0.5193	0.4757
TRAVOS	0.682	0.3008	0.6796	0.2943	0.4884	0.464
Personalized	0.793	0.1798	0.7406	0.2266	0.5754	0.414
CertProp	0.791	0.1854	0.7327	0.2417	0.5781	0.416
Shin	0.809	0.1576	0.7413	0.2314	0.5783	0.4123



# Conclusion

- DiffTrust: diffusion theory in social science
  - Adopt other users' trust evaluation through *social proximity*
- Comparison on the four real datasets
  - Consistently perform better in both *loosely-connected* and *well-connected* environments
  - Model trustworthiness of users new to the system

# Future work

- ❑ To model the trustworthiness of entities
  - Diffusion theory
- ❑ Consider physically spatial information and context in the experiments

**Thank You!**  
**Any Questions?**