International Journal of Advanced Research in

Computer Networking,Wireless and Mobile Communications

Volume: 2 Issue: 1 25-Apr-2015,ISSN_NO: 2320-7248

MODELING RELATIONSHIP IN TRUST FOR MULTI AGENT SYSTEM

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Abstract:-- *In command to collaborate in the sweepingthinsituation, crediblemediatorswant to be alerthonesty of executornegotiators for selecting suitable interaction partners. Most of the current computational faithmockupskindusage of the trusteesthemselfknowledge or reputation from public on executors to total the beliefmorals. However, in some circumstances, a trustedmanagermight have no involvement with a newdoer or might not find the gen about the reputation of the new trustee agent. And then the truster agent could not utilize the outmodedinstrumentsgrounded on skill or standing to infer some trust value for the new trustee. In this paper, we introduce a novel mechanism for estimating trustworthiness in such a condition. Our plannedmachine is built on the parallel in contours of the new trustee and ones of well known agents. A weighted combination model is used for participatingpracticebelief, standing and comparablehope.*

Keywords: Reliance · Status · Dependence propagation · Trust similarity · Multi-agents system.

1. Introduction:

In simple terms, an agent's trust in another can be understood as a belief that the latter's behavior will support the agent's plans. Subtle relationships underlie trust in social and organizational settings [Castelfranchi and Falcone, 1998]. Without detracting from such principles, this paper takes a narrower view of trust: here an agent seeks to establish a belief or disbelief that another agent's behavior is good (thus abstracting out details of the agent's own plans and the social and organizational relationships between the two agents). The model proposed here can, however, be used to capture as many dimensions of trust as needed, e.g., timeliness, quality of service, and so on.

For rational agents, trust in a party should be based substantially on evidence consisting of positive and negative experiences with it. This evidence can be collected by an agent locally or via a reputation agency or by following a referral protocol.From the computational point of view, Grandison and Sloman [3] define trust as a quantified belief by a truster with respect to the competence, honesty, security and dependability of a trustee within a specified context. This understanding of trust has been accepted and applied to constructing open distributed multiagent systems.

The current models fail to deal with the situation of a new entrant trustee, in which there is neither the experience trust nor the reputation of the trustee to refer. A question is how does a truster agent estimate some trust value about the given trustee in the situation? Intuitively, a simple solution for initiation of trust in this situation is assigning a random value for the trust of the new coming trustee. This will be fine if the model is applied to the application which has many contacts/transactions between trusters and trustees. Because this initial value of trust will be rapidly updated by the experience trust from contacts/transactions. Conversely, in the applications where the number of transactions are small, the initial value of trust will strongly affect on the lifetime of the overall trust of a trustee. Therefore, it is better to avoid the random initial value.

1.1 Drive:

Practical agent systems face the challenge that trust evolves over time, both as additional information is obtained and as the parties being considered alter their behavior.

1.2 Configuration:

It is clear that trust cannot be trivially propagated. For example, A may trust B who trusts C, but A may not trust C. However, we need to combine trust reports that cannot themselves be perfectly trusted, possibly because of their provenance or the way in which they are obtained.

- Trust in a party (i.e., regarding its being good): belief is high, disbelief is low, and uncertainty is low.
- Distrust in a party: belief is low, disbelief is high, and uncertainty is low.
- Lack of trust in a party (pro or con): uncertainty is high.

2. Comparison-Based Device for Trust Propagation

In this model, we distinguish three types of trust among agents in multiagent systems:

2.1 Familiarity trust:

The trust that a truster obtained based on the history of interaction with a trustee. An interaction is called a transaction, and trust from the interaction is called transaction trust.

2.2 Parallel trust

The trust that a truster obtained by reasoning itself on the similarity of a trustee with other well known trustees. A trustee is considered as well known with a truster if there is an interaction between the truster and the trustee and the truster has its own experience trust about this trustee.

2.3 Status

The trust about a trustee that a truster refers from other agents in the system. We assume that agents are willing and trustworthy to share their experience trust about some trustee to other agents.

2.4. Similar Trust

Similar trust is the trust that a truster obtained by reasoning itself on the similarity of a trustee with other well known trustees. Without loss of generality, we assume that there are n concerned characteristics {a1, a2, ...an}, which are objects or attributes of some object, to measure the similarity between two agents. There are several methods to measure the similarity between two objects (cf. D. Lin [11]).

3.Conviction from a PCDF

Because the cumulative probability of a probability lying within [0, 1] must equal 1, all PCDFs must have the mean density of 1 over [0, 1], and 0 elsewhere. Lacking additional knowledge, a PCDF would be a uniform distribution over [0, 1]. However, with additional knowledge, the PCDF would deviate from the uniform distribution. For example, knowing that the probability of good behavior is at least 0.5, we would obtain a distribution that is 0 over [0, 0.5) and 2 over [0.5, 1].

Similarly, knowing that the probability of good behavior lies in [0.5, 0.6], we would obtain a distribution that is 0 over [0, 0.5) and (0.6, 1], and 10 over [0.5, 0.6]. In formal terms, let p ∈ [0, 1] represent the probability of a positive outcome. Let the distribution of p be given as a function f : [0, 1] 7→ [0, ∞) such that R 1 0 f(p)dp = 1. The probability that the probability of a positive outcome lies in [p1, p2] can be calculated by R p2 p1 f(p)dp. The mean value of f is R 1 0 f(p)dp 1−0 = 1. When we know nothing else, f is a uniform distribution over probabilities p. That is, f(p) = 1 for p ∈ [0, 1] and 0 elsewhere. This reflects the Bayesian intuition of assuming an equiprobable prior. The uniform distribution has a certainty of 0. As more knowledge is acquired, the probability mass shifts so that f(p) is above 1 for some values of p and below 1 for other values of p.

3.1 Reputation

Reputation of agent j is the trustworthiness on agent j given by other agents in the system. We share the point of view given by Huynh et al. [8] who suppose that any agent in the system is willing and trustworthy to share its experience trust a bout a particular trustee to other agents. Suppose that j is an agent which the agent i has not yet interacted with but needs to evaluate to cooperate with. Let Vij⊆ A be a set of agents that an agent i knows and have had transactions with j in the past.

3.2 Evidence and Trust Spaces Conceptually

For simplicity, we model a (rating) agent's experience with a (rated) agent as a binary event: positive or negative. Evidence is conceptualized in terms of the numbers of positive and negative experiences. In terms of direct observations, these numbers would obviously be whole numbers. However, our motivation is to combine evidence in the context of trust.

As Section 1 motivates, for reasons of dynamism or composition, the evidence may need to be discounted to reflect the aging of or the imperfect trust placed in the evidence source. Intuitively, because of such discounting, the evidence is best understood as if there were real (i.e., not necessarily natural) numbers of experiences. Accordingly, we model the evidence space as E = R × R, a two-dimensional space of reals. The members of E are pairshr, si corresponding to the numbers of positive and negative experiences, respectively. Combining evidence is trivial: simply perform vector sum.

Definition 1

Define evidence space E = {(r, s)|r ≥ 0, s ≥ 0, t = r + s > 0} Let x be the probability of a positive outcome. The posterior probability of evidence hr, si is the conditional probability of x given hr, si [Casella and Berger, 1990, p. 298].

Definition 2

The conditional probability of x given hr, si is

$$\begin{aligned} f(x|\langle r,s\rangle) &= \frac{g(\langle r,s\rangle|x)f(x)}{\int_0^1 g(\langle r,s\rangle|x)f(x)dx} \\ &= \frac{x^r(1-x)^s}{\int_0^1 x^r(1-x)^s dx} \end{aligned}$$

$$where\ g(\langle r,s\rangle|x) = \begin{pmatrix} r+s \\ r \end{pmatrix} x^r(1-x)^s$$

Definition 3

Define trust space as T = {(b, d, u)|b > 0, d > 0, u > 0, b + d + u = 1}.

Definition 4

Let Z(r, s) = (b, d, u) be a transformation from E to T such that Z = (b(r, s), d(r, s), u(r, s)), where b(r, s) = αc(r, s), d(r, s) = (1 − α)c(r, s), and u(r, s) = 1 − c(r, s). One can easily verify that c(0, 1) > 0. In general, because t = r + s > 0, c(r, s) > 0. Moreover, c(r, s) < 1: thus, 1 − c(r, s) > 0. This coupled with the rule of succession ensures that b > 0, d > 0, and u > 0. Notice that α = b b+d.

4. VitalAssets and Reckoning

We now show that the above definition yields important formal properties and how to compute with it. Increasing Experiences with Fixed Conflict Consider the scenario where the total number of experiences increases for fixed α = 0.70. For example, compare observing 6 good episodes out of 8 with observing 69 good episodes out of 98. The expected value, α, is the same in both cases, but the certainty is clearly greater in the second. In general, we would expect certainty to increase as the amount of evidence increases. Definition 5 yields a certainty of 0.46 from hr, si = h6, 2i, but a certainty of 0.70 for hr, si = h69, 29i. Figure 1 plots how certainty varies with t when α = 0.5. Theorem 1 captures this property in general.

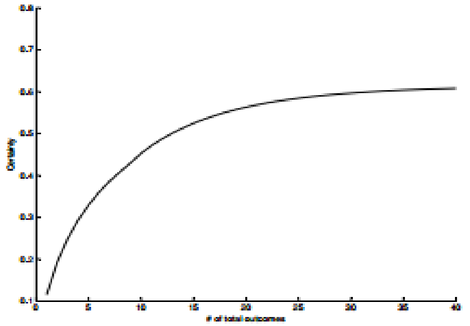


Figure 1: Certainty increases with t when conflict (α = is fixed; X-axis: t; Y-axis: $c(t)$

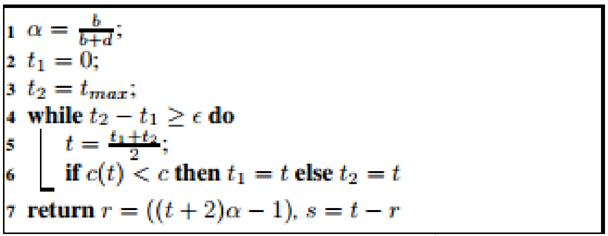
Theorem 1 Fix α. Then c(t) increases with t for t > 0.

Proof idea

Show that c ′ (t) > 0 for t > 0. The full proofs of this and other theorems of this paper are included in a technical report [Wang and Singh, 2006b].

5. Algorithm and Complexity

No closed form is known for Z −1 . Algorithm 1 calculates Z −1 (via binary search on c(t)) to anynecessaryprecision, ϙ > 0. Here tmax> 0 is the maximum evidence considered.



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$\alpha = \frac{b}{b+d}$;
$t_1 = 0$;
$t_2 = t_{max}$;
while $t_2 - t_1 \geq \epsilon$ do
    $t = \frac{t_1+t_2}{2}$;
    if $c(t) < c$ then $t_1 = t$ else $t_2 = t$
return $r = ((t+2)\alpha - 1)$, $s = t - r$
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Algorithm 1: Calculating $(r, s) = Z^{-1}(b, d, u)$

Theorem 2 The complexity of Algorithm 1 is Ω(− lg ϙ).

Proof:

After the while loop iterates i times, t2 − t1 = tmax2 −i . Eventually, t2 − t1 falls below ϙ, thus terminating the while loop. Assume it terminates in n iterations. Then, t2 − t1 = tmax2 −n < ϙ ≤ tmax2 −n+1. This implies 2 n >tmax ϙ ≥ 2 n−1 . That is, n > (lgtmax − lg ϙ) ≥ n − 1.

5.1 Overall Trust

Resulting from these partial trust measures, we may construct a definition of combination of these types of trust

Combination trust T_{ij} of agent i on agent j is defined by the formula:

$$T_{ij} = w_{ie} * E_{ij} + w_{is} * S_{ij} + w_{ir} * R_{ij}$$

whereEij , Sij , Rij are experience trust, similar trust and reputation about trustee j in the point of view of trusteri, respectively and wie + wis + wir = 1 are weights of these trusts. . Then, t2 − t1 = tmax2 −n < ϙ ≤ tmax2 −n+1. This implies 2 n >tmax ϙ ≥ 2 n−1 . That is, n > (lgtmax − lg ϙ) ≥ n − 1.

6. Conclusion

In this paper, we have introduced a new mechanism for trust propagation which is based on the similarity of a new trustee profile and the other well known agent ones. The trust inferred from similar computation mechanism has been combined in the weighted computation with the experience trust and reputation to achieve an overall trust. In our work, all agents are supposed to be faithful. It means that they always provide reliable information for computing reputation and similarity. However, in the reality, there may be some lying agents who intend to provide unreliable information for the sake of their own utility.

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