Trust Modeling in the Bright Internet Environment

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Extended Abstract

The significant growth of information and communication technologies (ICTs) in Industry 4.0 and Society 5.0 produces exceptional advantages under increasing cybersecurity threats. As a fundamental variable, trust plays a critical role at different levels in every user communication in the bright internet environment, which has brought significant attention by researchers in diverse disciplines. Notwithstanding, many studies have been shown that modeling trust is still a complex, open, and unachieved question in the context of bright internet. An essential characteristic of trust that has not been studied is that trust can catastrophically collapse to distrust each stage of its evolution among users. Trust modeling mainly deals with evaluating trust relations in computational models, and trust management is employed to illustrate how to obtain confirmation and assess risk.

This research mainly focuses on trust modeling using stochastic modeling, incorporating its chaotic features between two users. Our novel stochastic trust model would be integrated with trust inference and decision making in trust management systems. Moreover, we provide sample patterns for joint and triplicate trust relationships in the buyer-seller supply chain or communication networks.

Keywords

Phase-type distributions, Trust relationship, Trust modeling, Social media, Communication networks

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### Modeling of trust relationships with Phase Type Distribution

Modeling of mutual trust relationships

This section is dedicated to model trust relationships as shown in Figure 4. As it is stated previously, trust can be associated with relationships between people. Moreover, the trust concept is related to relationships within and between social groups (families, friends, communities, organizations, companies, nations, etc.). It is a popular approach to frame the dynamics of inter-group and intra-group interactions regarding the trust. In addition, in human-computer interaction, a function of reliability and availability can be considered as a communication trust.

**Figure 4. Trust relationship**
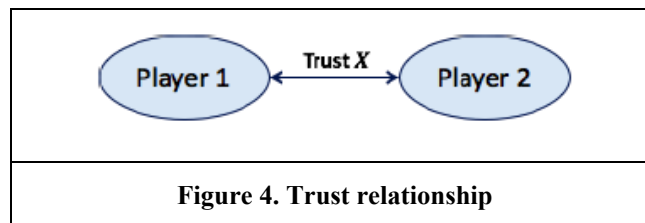
Here, we suppose that two parties are related to each other in a trust-based relationship. The relationship between these two parties is alleged to be in three states. The highest level of trust is considered to be complete trust in which two parties confidently trust each other's behaviors, promises, and contracts. In the real world, there are a few examples of complete trust. Alternatively, full mistrust is the lowest level of trust in which two parties do not believe that the other party is telling the truth or will fulfill a promise. Because of the chaotic feature of the trust, it is conceivable for the relationships to move to the complete distrust when the relationship is in any level of trust. This is common in the real world where there are many examples of such an abrupt movement in the romantic life of two individuals or business relationships of two cooperating companies. In reality, the level of trust between two parties is chiefly located in the medium level, which could be both progressed to complete trust or degraded to complete distrust. Figure 5 illustrates different states of trust between two parties.

Trust and distrust are threshold points on a continuum of probability assessment as it is stated by [22]. We trust someone if the likelihood that he will fulfill his obligation lies above a particular threshold. We distrust someone if the likelihood that he will carry out a promise is sufficiently low. A complete trust would have a probability of one while complete distrust would have a probability of zero.

Figure 5. Trust transition
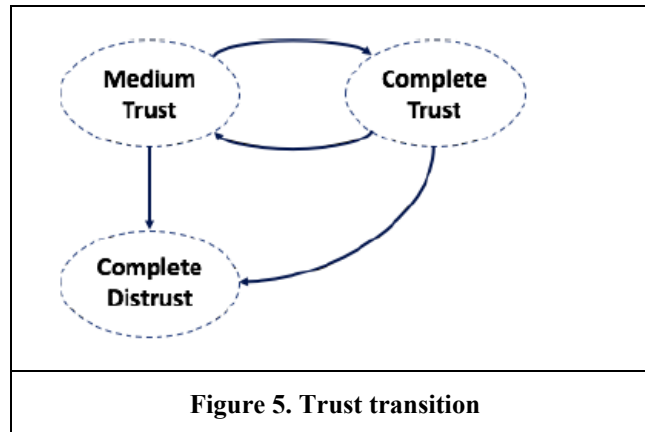
Considering the proposed conceptual model in Figure 5, the complete distrust status is viewed as an absorbing state because it is not possible to exit this status after entering there. The structure of the trust model is similar to the proposed modeling approach in Section 2. Consequently, this process could be modeled as PTD model in which medium trust status could be considered as $X = 1, ..., r$ and complete trust status could be defined as $X = r + 1, r + 2, ..., n - 1, n$, where $X = n$ is the complete trust status and $X = 0$ is the complete distrust status. The PTD model is shown in Figure 6.

Figure 6. State transition diagram Markov transition
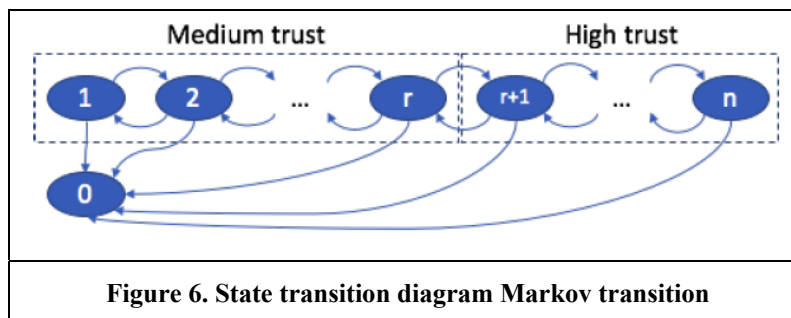
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