Chapter 5
Norms-Adaptable Agents for Open Multi-Agent Systems

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ABSTRACT
Norms and normative multi-agent systems have become the subjects of interest for many researchers. Such interest is caused by the need for agents to exploit the norms in enhancing their performance in a community. In open agent systems, an agent is not usually and explicitly given the norms of the host agents. Thus, when it is not able to adapt the communities’ norms, it is totally deprived of accessing resources and services from the host. Such circumstance severely affects its performance resulting in failure to achieve its goal. While several studies have addressed this issue, their detection mechanisms are restricted to the use of sanctions by third party enforcement. Consequently, this study attempts to overcome this deficiency by proposing a technique that enables an agent to detect the host’s potential norms via self-enforcement and update its norms even in the absence of sanctions from a third-party. The technique is called the Potential Norms Detection Technique (PNDT).

INTRODUCTION
The concepts of norms and normative systems are used to determine the behaviors of agents within a community and are commonly accepted as efficient means to normalize their behaviors (Alberti et al., 2011). Norms represent desirable behaviors for a population of a natural or artificial community and they are generally understood as rules indicating actions they are expected to perform that are either obligatory, prohibitive or permissive based on a specific set of facts. Coleman (1998) defines two main categories of norms: conventions and essential norms. Correspondingly, Villatoro (2011) grounded the difference between conventions and essential norms. Conventions are natural norms that emerge without any enforcement. Conventions solve coordination problems when there is no conflict between an individual and the collective interests, such as everyone conforms to a desired behavior. Conventions...
fix one norm amongst a set of norms which is always efficient as long as each one in the community employs the same norm i.e. greetings, driving side of the road (Villatoro, 2011). Essential Norms solve or ease collective action problems when there is a conflict between an individual and the collective interests (Villatoro et al., 2010). For example, “the norm not to pollute urban streets is essential in that it requires individuals to transport their trash, rather than dispose of it on the spot, an act that benefits everyone” (Piskorski et al., 2011).

Intelligent software agents have been widely used in distributed artificial intelligence and due to their autonomous, self-interested, rational abilities (Mahmoud et al., 2016c, 2016d, 2016e; Jassim et al., 2016), and social abilities (Subramainan et al., 2016a, 2016b; Mahmoud et al., 2013), agents are well-suited for automated negotiation on behalf of humans (Kexing, 2011).

In agent communities, norms are used to regulate agents’ behaviors but agents may decide not to comply with the norms if this benefits them (Mahmoud et al., 2016a, 2016b). Consequently, norms enforcement is designed to offset these benefits and thus the motives for not complying with the norms (Perreau de Pinninck et al., 2010). To perform the enforcement, it requires a process that is able to detect the activity of the norms and their probable violations and handle this violation (Vázquez-Salceda et al., 2004). According to Perreau de Pinninck et al. (2010), norms enforcement can be achieved through a controller via stopping forbidden actions or applying reward and penalty on agents. However, the literature presented two types of enforcements, which are self-enforcement and third-party enforcement. Self-enforcement is also called as internally-directed enforcement (Hollander & Wu, 2011). It occurs when an agent punishes itself for violating a norm, which could happen when an agent has internalized the norm and is influenced by some forms of emotion or awareness. In self-enforcement, the violator performs its own penalty and this is often because its actions are not coordinated with the actions of other agents. In other words, there is no third-party involved in its actions to apply punishment (Posner & Rasmusen, 1999).

The literature referred to third-party enforcement type as externally-directed enforcement (Hollander & Wu, 2011). A third-party enforcement agent has the ability and authority to implement sanctions (reward or penalty) (Grossi et al., 2010; Mahmoud et al., 2014). It occurs when an agent observes another agent violating a norm (Flentge et al., 2001; Galan & Izquierdo, 2005) or during norm spreading when an agent does not adopt the norms of others. While norms and normative systems have been the subject of intense investigation (Castelfranchi et al., 1998; Broersen et al., 2001; Sadri et al., 2006), norms detection is quite a recent research issue, in which an agent attempts to decipher the normative protocol of a group of local agents. A search on the related work in norms detection shows a few results (Andrighetto et al., 20010; Savarimuthu et al., 2010; Centeno & Billhardt, 2012).

Norms detection is a process of updating an agent’s norms based on discovering a society’s potential norms through some detection mechanism, which rely on observing or interacting with other agents to infer the potential norms. According to (Hollander & Wu, 2011; Boella et al. 2008), when researchers attempt to build a normative multi-agent system, norms detection is one of main challenges faced by the designer. The literature provides other terms for norms detection such as norms recognition, norms adaptation (Hollander & Wu, 2011) and norms identification (Savarimuthu, 2010).

Norms detection is inspired by the process of norms learning and norms cognition (Hollander & Wu, 2011; Savarimuthu, 2010). Several studies have been made by researchers on norms learning based on mechanisms of imitation (Epstein, 2001; Andrighetto et al., 2010); social learning (Sen & Airiau, 2007; Bosse et al., 2009); case-based reasoning (Campos et al., 2010); and data mining (Symeonidis &