ELSEVIER

Complex Adaptive Systems, Publication 3
Cihan H. Dagli, Editor in Chief
Conference Organized by Missouri University of Science and Technology
2013- Baltimore, MD

Domain Ontology of Hand-drawn Avatars as Online Self-representations for Cyber Forensics

Cheong Lee Mei*, Nor Adzlan Jamaludin

Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Malaysia, Shah Alam 40450, Malaysia

Abstract

The idea of concepts and relationships in the organization of hand-drawn avatars can be defined and identified with ontology. Hand-drawn avatars as online self-representation can be used for criminal investigation in cyber space. These iconic self-representations are important as supporting evidence for other physical evidence in forensic investigation. Informal knowledge about avatars as online self-representation is acquired by considering the broadest possible categories of hand-drawn avatars among 210 participants of ages between 21 and 22 years old with no prior knowledge of readily available online avatars. An analysis of an earlier research yields nine categories of the avatars: inanimate object, cartoon, humanoid, male figure, female figure, insect, animal, plant, and hybrid form. The common goal in information retrieval is to retrieve as many documents as possible from a collection that are closely related to an investigator's query. In this paper, we propose a model to support cyber forensics by utilizing an AvatarDrawn Ontological Knowledge Base (AOKB) in a document retrieval system. An advantage of this approach is that the AOKB can be progressively improved through definitions of new entities to expand its domain knowledge. An algorithm for semantic hand-drawn image retrieval is written to provide comprehensive and objective information.

Keywords: ontology; avatar; self-representation; document retrieval; hand-drawn avatars

1. Introduction

The ways in which people reveal their identities are rapidly changing. People signal who they are through their physical presence and behavior in the context of the real world as well as in the virtual world. A range of physical and behavioral cues can be examined to predict other unknown information about people in order to build an accurate identity. Vasalou and Joinston [1] have drawn attention towards the perception and behavior of a person through his avatar. Their study investigates how users customize avatars for self-representation in three online settings: blogging, dating and gaming. An avatar is a graphical representation of the online user. It is beginning to replace the creation of precise and photorealistic representations.

---

* Corresponding author. Tel.: +6016-650-4649; fax: +603-5543-5301.
E-mail address: dianne@tmsk.uitm.edu.my.

Hand-drawn avatars as online self-representation can be used for criminal investigation in cyber space. Hand-drawn avatars are important as supporting evidence for other physical evidence in forensic investigation. They can be used in the process of investigating cyber crime cases, and for data mining of cyber crime; classification, clustering, association, and detection of crime types, crime cases, evidences and criminals. It is necessary to collect cyber evidence together with general evidence so as to classify documents for effective investigation, including document retention and exchange. Moreover, general cyber crime is connected with general crime by evidence from digital data and cyber space.

This paper identifies hand-drawn avatars as online self-representation which may indicate identity. We present domain ontology of hand-drawn avatars as online self-representation. This ontology can be used to produce faithful electronic copies of hand-drawn avatars for archival storage and exchange; and to create abstracts of electronic replica that are easy to share and reuse. It is more than a data model as it includes concepts (categories of avatars), attributes (subcategories of avatars), instances (specific objects), and relations of concepts and instances. The purpose of this ontology is to establish a reliable baseline of avatars and the rationale in creating the corresponding avatar.

The structure of this paper is as follows. Section 2 highlights related work on identity detection through avatars and the application of ontology in modeling forensic knowledge. Section 3 presents the research model and ontology. In Section 4 shows how information pertaining to avatar and its corresponding motive for being drawn can be retrieved for forensic purposes while Section 5 presents an algorithm for semantic hand-drawn avatar retrieval. The paper concludes that AvatarDrawn Ontology Knowledge Base (AOKB) has the ability to explicitly describe data semantics in a common way which is independent of data source characteristics.

2. Related Work

The virtual environment allows the individual to construct his/her profile consisting of avatar, sharing text, images, photos and links to other members by applications and groups. Hence, it is appropriate to review related work on identity detection through avatars, and the application of ontology in modeling forensic knowledge.

2.1. Identity detection through avatars

Sherry Turkle [2] in her book, "The Second Life: Computers and the Human Spirit", introduced the idea that computers were not just tools for work but also for exploration of oneself. She [3] further expanded the ideas in another book, "Life on the Screen: Identity in the Age of the Internet," to include new genre of the online game world – players were given the opportunity to assume a different identity. Following that, players are able to create their avatars as online representations in a more realistic detail [4]. Most often the design features span across the use of imaginary to realistic representations [5, 6]. Additionally, the levels of expression in the avatars are associated with self-disclosure resulting in having an impact on the perceptions by others in the online community [7]. He asserts that the avatars resemble people as who they are in real life in many aspects when there are no assigned roles or races.

It is found that people prefer to take time to create unique self- representations that convey something about their true identity, particularly gender [8]. People tend to reflect their own appearance when personalizing an avatar for display within their blog [9]. Subsequent study by Vasalou and her team [1] shows three distinct motivating factors in designing avatars: the avatars were aligned to an actual self; ambiguity which allows users to create playful self-representation; and the avatars were used to embody a message as an expressive signal.

Interestingly, Taylor [10] notes that an avatar enables the creation of a virtual identity that is distinct from the one in real life. People do create avatars that represent themselves as radically different from themselves in looks or behavior. Avatar design thus affords a person to explore different looks to engage in anticipatory behavior of someone older or a different gender. For young adult, in particular, the development of identity plays an important part of their social life. Being online has become an increasingly important part of their social life where they initiate and develop relationships [11, 12]. Kafai and her team [13] examined how teenagers respond and conceptualize their online self-representations. They concur that avatars designed by teenagers may offer a particularly promising window into understanding how they think about their self-representation.