INTELLIGENT SENSING: ONTOLOGY BASED APPLICATION

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by

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Submitted

in fulfillment of the requirements of the degree of Doctor of Philosophy

to the

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To my family

Certificate

This is to certify that the thesis titled **Intelligent Sensing: Ontology Based Application** being submitted by **Ms. Deepti Goel** to the **Department of Electrical Engineering**, Indian Institute of Technology Delhi, for the award of **Doctor of Philosophy** is a record of bona-fide research work carried out by her under my guidance and supervision. In my opinion, the thesis has reached the standards fulfilling the requirements of the regulations relating to the degree. The work presented in this thesis has not been submitted elsewhere, either in part or full, for the award of any other degree or diploma.

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Delhi Deepti Goel

Abstract

Sensors are producing the bulk of media data all around the globe, generating abstractions and perceptions of the real-world. However, the observations captured by sensors are uncertain and are of heterogeneous schema and media formats which makes them difficult to manage and use for intelligent applications. In this thesis we address these challenges by considering media-rich ontology-based representation for sensor data at a feature level and domain resources at knowledge-level, contributing to discovering and traversing of media content conveniently. The automated semantic-based multimedia system tailors to individual user needs and presents an influential medium to combat information glut by automatically suggesting services and actions to the users.

Our specific contribution lies in automatically detecting the contextual aspects from the large collection of sensor observations, ranging from observations detected at a particular point of time to multiple states of observations in a dynamic temporal dimension that generates one complete event. The context information associated with an event connects sensor data with temporal and spatial aspects. The continuous streaming of this raw context provides evidence for recognizing an activity or event within media documents, enabling the possibility of performing real-time analysis and tracking of evolving situations. We employed Multimedia Web Ontology Language (MOWL) to build a context-based application in Complementary Garment domain and to build a context-aware smart city applications that can transparently adapt to real-world changes. We propose an ontology evolution scheme to refine and update a prior ontology structure and parameters, by utilizing observed data instances. We verified our approach

through an adaptive context-aware Smart Traffic application, by associating sensory observations to semantically derive and interpret traffic contexts, and to predict traffic situations by utilizing dynamic reasoning capabilities of the MOWL framework. The ability to disambiguate and automatically derive context dimensions from sensor observations for various sensor oriented applications operating in a dynamic environment reflects the flexibility of our reasoning approach. This research establishes the viability of ontology-based reasoning for real-time applications needing probabilistic responses.

सार

सेंसर दुनिया भर में मीडिया डेटा के थोक उत्पादन कर रहे हैं और वास्तविक दुनिया की धारणाएं उत्पन्न कर रहे हैं। हालांकि सेंसर द्वारा पकड़े गए अवलोकन अनिश्चित हैं और विषम स्कीमा और मीडिया प्रारूपों के होते हैं जो उन्हें प्रबंधित करने और उपयोग करने में मुश्किल बनाते हैं। इस थीसिस में हम मध्यस्थता पर विचार करके इन चुनौतियों का समाधान के लिए ऑन्टोलॉजी-आधारित प्रतिनिधित्व सेंसर डेटा के लिए और डोमेन संसाधनों पर ज्ञान-स्तर में योगदान के लिए उपयोग कियk है। व्यक्तिगत उपयोगकर्ता की जरूरतों के लिए स्वचालित अर्थ-आधारित मल्टीमीडिया सिस्टम स्वचालित रूप से सेवाओं और कार्यों का सुझाव देकर सूचना का मुकाबला करने के लिए प्रभावशाली माध्यम प्रस्तुत करता है।

विशिष्ट योगदान में से प्रासंगिक पहलुओं का पता लगाने में स्वचालित रूप से निहित है सेंसर टिप्पणियों का बड़ा संग्रह एक विशेष बिंदु पर पाया टिप्पणियों से लेकर एक गतिशील अस्थायी आयाम में टिप्पणियों के कई राज्यों के लिए समय उत्पन्न करता है। एक घटना से जुड़ी संदर्भ जानकारी सेंसर डेटा को साथ जोड़ती है। इस कच्चे संदर्भ की निरंतर स्ट्रीमिंग सबूत प्रदान करती है मीडिया दस्तावेज़ों के भीतर किसी गतिविधि या घटना को पहचानने के लिए प्रदर्शन की संभावना को सक्षम करने के लिए वास्तविक समय विश्लेषण और विकसित स्थितियों की

ट्रैकिंग। हमने मल्टीमीडिया वेब को नियोजित किया ऑन्टोलॉजी भाषा पूरक परिधान में एक संदर्भ-आधारित अनुप्रयोग बनाने के लिए डोमेन और एक संदर्भ-जागरूक स्मार्ट शहर अनुप्रयोगों का निर्माण करने के लिए जो पारदर्शी रूप से अनुकूलित कर सकते हैं वास्तविक दुनिया में परिवर्तन। हम एक ऑन्टोलॉजी विकास योजना का प्रस्ताव करते हैं जो एक पूर्व ऑन्टोलॉजी को परिष्कृत और अद्यतन करने के लिए है संरचना और मापदंडों मनाया डेटा उदाहरणों का उपयोग करके। हमने संवेदी टिप्पणियों को जोड़कर एक अनुकूली संदर्भ-जागरूक स्मार्ट ट्रैफिक एप्लिकेशन के माध्यम से हमारे दृष्टिकोण को सत्यापित किया ट्रैफ़िक संदर्भों को शब्दार्थ रूप से प्राप्त करने और व्याख्या करने के लिए और ट्रैफ़िक स्थितियों का अनुमान लगाने के लिए ऑन्टोलॉजी ढांचे की गतिशील तर्क क्षमताओं का उपयोग करना। विघटित करने की क्षमता और स्वचालित रूप से विभिन्न सेंसर उन्मुख के लिए सेंसर टिप्पणियों से संदर्भ आयाम प्राप्त करते हैं गतिशील वातावरण में काम करने वाले अनुप्रयोग हमारे तर्क के लचीलेपन को दर्शाते हैं दृष्टिकोण। यह शोध वास्तविक समय के अनुप्रयोगों के लिए ऑन्टोलॉजी -आधारित तर्क की व्यवहार्यता स्थापित करता है संभावित प्रतिक्रियाओं की जरूरत है।

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