Hidden Markov Model for Dealing with Contexts Application

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I. INTRODUCTION

The main purpose of current article is to integrated capabilities of computer systems in our lives and providing relevant services in accordance with the requirements of persons. All communication is based on the context, where the context is understood: Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves.

The context system is generally concerned with the interaction between computer systems and the real world, with the embedding of computing resources in real-world objects. Therefore, interfaces between the physical and the virtual world mediate the mutual influence that both worlds have on each other. Interfaces that transport information from the physical to the virtual world are called sensors, interfaces from the virtual to the physical world are called actuators, as depicted in Fig. 1.

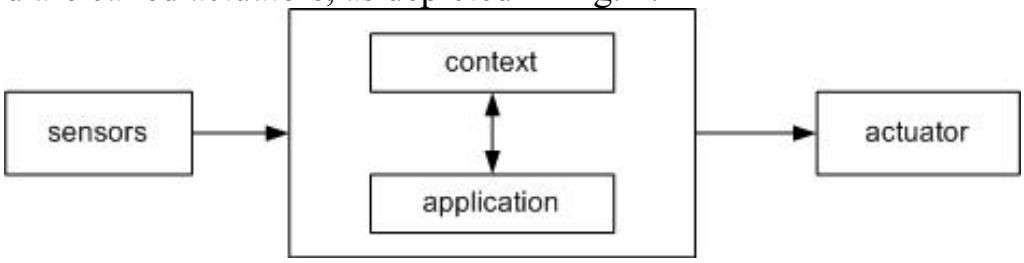

Fig. 1 Using context within a system.

A system is context if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task and might prediction the context.

II. CONTEXT PREDICTION

Context Prediction is an important aspect of Context Computing that aims at inferring future contexts from past contexts.

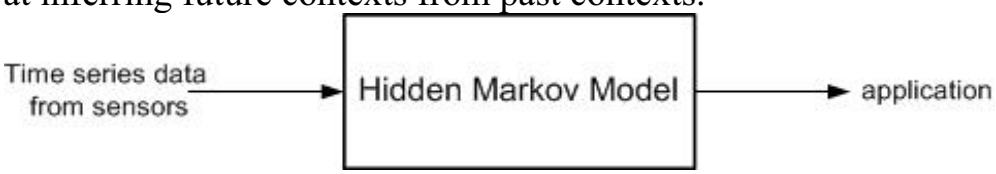

Fig. 2 Context prediction architecture.

Input Data:

The possibly multiple input data streams are heterogeneous and complex, exhibiting the following characteristics:

A (single-dimensional) time series can be defined as a mapping from points in time to data values: $x : T_0 \rightarrow X$, where T_0 denotes the set of sample times and X is the set of possible sample values.

Output Data:

The output of the system should characterize:

- The current context.
- Predicted future contexts, possibly for different time horizons.

The approach of using time series prediction independently on each of the context classes degrees of membership has a significant disadvantage that is not unlike the reason why we chose not to predict sensor or feature values directly. Many of the categorical time series prediction methods assume the Markov property, which supposes independence between time steps. A Markov model supposed that the next state depends solely on the current state, and consequently any relationship between separated states must be communicated via transitional states.

This is a statistical model where the system that is represented is assumed to be a Markov process with observed states and unknown context parameters. The aim is to find out the unknown parameters (context types or an inference of a higher-level situation) from the context data on disposal. Hidden Markov Model (HMM) [2] requires training phase in order to initially categorize activities and its states. HMM builds statistical memory of sequences of events that are reliable and robust to changes and provide higher-level knowledge deduction. It is mostly used for modeling human behavior, because it is able to recognize states caused by the action.

As users are free to move into environment, a position is only dependent on a previous position. HMMs are appropriate for modeling processes with inherent temporality that unfold in time, where a state at time t is transited only from the state at t-1. The constraints of physical space and human movement introduce in variances that can be used as the underlying hidden stochastic process. HMMs are particularly efficient for models that are based on data that is missing, incomplete or contradictory.

HMMs are to be considered the standard model for time series classification in many areas, e.g. speech recognition, handwritten character recognition, gesture recognition or segmentation of DNA sequences. In context computing, they have been applied at various levels, like recognizing location based on audio and video [1], task prediction [3] or action recognition [4]. In the case of HMMs the input can be either real valued or a set of discrete states and the output is a discrete state.

III. CONCLUSIONS

In this article we have observed some properties of the Hidden Markov Model which used in context system. Context systems strive for adaptation to user needs by utilizing information about the current context in which a user's appliance works. The using Hidden Markov Model have given new quality of ubiquitous systems may be reached if context awareness is enhanced by predictions of future contexts based on current and previous context information. Such a prediction enables the system to proactively initiate actions that enhance the convenience of the user or that lead to an improved overall system.

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