

# **Video Based Animal Behavior Analysis**

*Xinwei Xue and Thomas C. Henderson*

UUCS-06-006

School of Computing  
University of Utah  
Salt Lake City, UT 84112 USA

June 6, 2006

## ***Abstract***

It has become increasingly popular to study animal behaviors with the assistance of video recordings. The traditional way to do this is to first videotape the animal for a period of time, and then a human observer watches the video and records the behaviors of the animal manually. This is a time and labor consuming process. Moreover, the observation results vary between different observers. Thus it would be a great help if the behaviors could be accurately derived from an automated video processing and behavior analysis system. We are interested in developing techniques that will facilitate such a system for studying animal behaviors.

The video based behavior analysis systems can be decomposed into four major problems: behavior modeling, feature extraction from video sequences, basic behavior unit discovery and complex behavior recognition. The recognition of basic and complex behaviors involves behavior definition, characterization and modeling. In the literature, there exist various techniques that partially address these problems for applications involving human motions and vehicle surveillance.

We propose a system approach to tackle these problems for animals. We first propose a behavior modeling framework, and a behavior model consisting of four levels: physical, physiological, contextual, and conceptual. We propose to explore information-based feature extraction and dimension reduction techniques, such as mutual information. Basic

behavior units (BBUs) are determined from these features using the affinity graph method. A maximum likelihood approach to choose optimal parameters, such as affinity measures, and feature subsequence window size. Furthermore, we formulate a hierarchical approach and Hidden Markov Model (HMM) approaches, incorporated with our behavior models to recognize complex behaviors in laboratory animals.