# Generalized Biological Motion Perception

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## 1 Problem Statement

Animals are capable of producing unique movements which are rarely seen elsewhere in nature. Psychology research has shown that both humans and animals innately perceive these biological movements differently than other motions (1). When presented with moving point-light displays, jumping spiders turned towards biological structured motion significantly more than the random control stimuli (2). Two day old human babies showed the same behavior in a similarly structured experiment (3). These results suggest that biological motion detection is an intrinsic capability for many animals and plays a large role in how they direct their attention.

An effective biological motion detector could be a useful stage in a variety of computer vision application pipelines. Furthermore, this information could improve autonomous agents' ability to interact with their environment. There has been extensive research on detecting motion in videos, and many effective solutions exist (4). However, research on differentiating biological motion is much more limited and has been mainly application specific. A 2017 paper, *Detecting Biological Motion for Human-Robot Interaction*, explored biological motion perception to control robot attention (5). This paper extracted features specific to biological motion and trained a successful classifier for their application. However, their solution was far from general, as all biological motions in the training and testing set were human movements, and the number of non-biological motions was limited. Additionally, the paper noted struggles in correctly classifying human motions not seen in the training set. Another paper focused specifically on the underwater detection of human movements (6).

Our goal is to develop a generalized model for biological motion perception which can be applied across many domains. We plan to use a much larger and more diverse data set than previous approaches, and compare the performance of multiple models and feature extraction methods. As a baseline we will assess the performance of the 2017 paper's methods when trained on the same data set.

## 2 Data

We plan to use the Youtube 8M segments data set for this project (7). This data set contains 6.1 million labeled Youtube videos including over 390,000 videos of pets and animals. Our task will be a binary classification problem. To get motion labels we will run a standard motion detection on a much smaller subset of the data set, half of which will be animal videos. We will manually check that all motion sections and labels are accurate before adding them to the final data set.

## 3 Method

The previous papers in this space used hand engineered features such as the two thirds power law and Fourier motion analysis. We want to see how well these features perform on a more inclusive data set. If hand engineered features do not achieve the desired results we will be using PCA and neural networks on higher dimensional videos for automatic feature extraction. For classification, we

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plan to experiment with a variety of methods like SVM, regression models and neural networks as classifiers. We will choose the simplest model that classifies our data well.

## References


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