NAZARBAYEV UNIVERSITY
SCHOOL OF SCIENCE AND TECHNOLOGY

Computer Science Department
Kickoff Document

Proposer:	Martin Lukac
Topic:	Real-time football game action prediction.
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Executive Summary

Real-time action prediction based on video is an important problem in computer vision field, and it has many possible applications. For example, in sports games by predicting the next action we can focus the camera on the region where it is going to happen, so the viewer will not miss the interesting moments of the game.

In this project, we propose a method for real-time action prediction of a football game. While in general action prediction consists of estimating the category of actions, here we focus on the football game and provide a method to directly estimate the next action of each team. For these several images, features are extracted such as players' position, ball's position, referee position, and a recurrent neural network is trained to predict actions.

Firstly, object detection should be implemented, so the coordinates of the players and ball will be recorded for each frame. Then this dataset will be used as an input for Neural Network to obtain the model which will predict the next action.

System Description

1) Make a literature of action prediction

2) Design and implement front-end (final result-rendering) and back-end (real-time action estimation):

   (a) the back-end is a non-parametric autonomous system estimating next action based on extracted features.

   (b) Front-end displays real time the action type, its location, direction and magnitude

3) The action estimation is designed in a module based fashion: modules are to be designed for each step of the processing pipeline

4) The algorithm should verified on different games such as ice hockey, basketball or volleyball

5) Write a report to explain step-by-step your approach (potentially a conference paper)

Hardware and Software Requirements

Hardware:

- Standard PC.

Software:

- Programming: Python/C/C++/PHP/Java/.Net.

Evaluation Criteria and Plan

Our system will be evaluated according to the categorization accuracy and performance criteria. Accurate algorithm is essential, but it must be reasonably efficient in terms of processing time. System accuracy will be calculated by hit-miss criteria. Performance is measured in the number of correct action predictions.

Risks and Contingency Plans

GPU that support CUDA is required, without it we will not be able to train our model.

Objectives

Fall 2019

- Write a step-by-step report that explains the approach we use
- Read the related papers on this topic.
- Describe the method for data set creation (autonomous annotation) at various granularity levels
- Describe the pipeline using probabilistic/formal framework
- Design a modular approach so that various components algorithms can be tested

Spring 2020 (tentative)

- Optimize the pipeline for real-time processing
- Design front-end for demo and visualization
- Conduct the performance evaluation based on related works.
- Write a final report

Tasks to be Accomplished

Fall 2019

- Object detection – September 20 (Mansur)
- Image transformation – September 27 (Mukhamejan)
- Create dataset – October 4 (Temirlan)
- Data Manipulation for LSTM training- October 11 (Temirlan, Mansur)

Spring 2020 (tentative)

- Not decided yet

Deliverables

Fall 2019

- ❑ Kickoff Document (this document)
- ❑ Summary of the related works.
- ❑ Specification and Design Document
- ❑ Front-end showing the anticipated action
- ❑ Back-end predicting the action
- ❑ Interim Presentation
- ❑ Semester Final Presentation, Report and Deliverable (the system itself)

Spring 2020 (tentative)

- ❑ Project Plan Revision Document

- ❑ Object extraction and background subtraction
- ❑ Action prediction for both teams
- ❑ Performance evaluation. (compare your approach to some of the related works)

- ❑ Project Poster

- ❑ Final Project Presentation, Report and Deliverable (the system itself)

References and Further Reading