Generating NFL Game Headlines from Box Score Statistics

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I. Abstract

In this paper, we introduce a new method by which to extrapolate key game statistics from a complete, purely numerical box score in order to produce a one-sentence summary of the game. Through identifying the particular game figures of greatest importance, the system is able to generate informative headlines that effectively highlight the most significant elements of the particular game. In particular, we describe a system that: (a) successfully utilizes a neural network to identify the significant elements of information necessary to summarize the complete set of data; (b) uses the important data components to generate complete, comprehensive headlines. In this paper we explore the application of the methods to football games played in the National Football League (NFL), but the same approach may be applied to other sports or to a number of other applications.

II. Introduction

Sports analytics is an emerging field that seeks to incorporate principles of big data analytics into the world of sports. Data in this arena is extensive, and largely publicly accessible, due in part to the economic appeal of the sports industry as well as the popular public interest in sports. Yet, although considerable work has been completed in the field, much of the work centers on game prediction and individual player evaluation as these applications provide tangible economic benefits to the team franchises. While work for these applications is ongoing, there has been significantly less work in the process of analyzing a complete set of statistics to extrapolate the significant components within a particular game.

Whether a key player's performance or the overall struggle in the contest, concluding such information currently requires either watching the complete game or a comprehensive understanding of and ability to read thorough a publicly available box score. A popular alternative to the two is to read game summaries written by sports professionals, whose expertise in the matter enables them to recap a complete game in a condensed form that is understandable to any reader.

This paper explores the potential of machine learning and natural language processing approaches and techniques to extract the important game performances from the box score of NFL games in order to automatically generate these summarizing game headlines. In particular, the paper explores various approaches consisting of neural networks and a variety of generative models to develop an effective system that is capable of completing the currently manual task. Some challenges faced by the system include summarizing a game from a largely naive data set that, in actuality, gives but a glimpse into the complete time-dependent game riddled with the intricacies common to sports. To help combat such issues, we simplified the problem statement to only involve the summarization of events in the actual game, without incorporating information that would require citation outside of the box score. As a result, injury reports, playoff contention, and game disputes are not incorporated into the headlines generated by the developed system.

A. Motivation

From sports to Wall Street, extrapolating key figures from a restricted set of data is an ongoing area of research with applications in a variety of fields. In addition, summarizing the identified key figures in a comprehensive headline may prove instrumental to fields in which language proves more powerful than numbers. As such, although this paper focuses on the information extraction and summarization of football games from box scores,

the methods described in this paper may by applied to far reaching applications.

III. Related Work

Generation of somewhat short sentences using Markov chains and stochastic methods have been shown to be quite simple and effective in generating poetry [1] [2], so we focused on applying these same principles in synthesizing valid headlines. This method yields a good way for text generation learned from examples; however, there is relatively much less research in the topic of generation solely from a combination of statistics and their corresponding text examples. Other, more syntactically-based models geared toward dialogue systems [3] [4], were shown to be inapplicable due to the lack of grammatical structure of the headlines in our data. Wen et. al. [5] presented an empirically-tested LSTM model capable of generating linguistically varied responses, but applying a deep, recurrent model to our problem proved hard due to the lack of data and difficulty of integration of the statistics in training.

Football game summaries have been explored by Nichols et. al. [6] and Chakrabarti & Punera [7], but both methods relied on learning data directly from Twitter and were uninformed by the statistics of games, as our model was.

IV. Data Collection

The data used by the system was extracted directly from ESPN's publicly accessible website1. The website contains comprehensive historical statistics for the past ten seasons of NFL games (2007-2016), with a complete box score for each game played throughout each season. From these box score, we extracted twenty-eight key statistics that would provide substantial insight into each overall game. These key statistics are summarized in Figure —-. In addition to the statistics extracted directly from the box score, we also incorporated team specific information for each game, such as the teams' city and acronym. This information proved useful in the annotation of the game headlines described below.

In addition to the box score data, each game on the website also has an accompanying article headline that was manually written by a professional sports writer following the game. We scraped this headline for each of the games for use as training data for our system. However, as described in the next section, our approach took into consideration not the headline provided directly from the website, but a general form of the headline. To generalize the headlines, we removed all game specific names and figures and replaced them with identifying tags. A few examples of the general form headlines can be seen in Figure —-. The initial process was completed automatically but required additional manual processing to ensure accurate annotation of the data. After the data was compiled and annotated, we removed any game data with an accompanying headline that incorporated information external to the actual gameplay, such as injury reports, playoff contention, and game disputes. In conclusion, our final dataset consisted of data and a headline from 1742 individual games.

V. Approach

1.

VI. Results

VII. Contribution

A. Parker Greene

B. Itamar Belson

C. John Clarke

References

[1] Kenner, Hugh; O'Rourke, Joseph (November 1984). "A Travesty Generator for Micros". BYTE. 9 (12): 129-131, 449-469.

[2] Hartman, Charles (1996). *Virtual Muse: Experiments in Computer Poetry*. Hanover, NH: Wesleyan University Press.

[3] Alice H. Oh and Alexander I. Rudnicky. 2000. "Stochastic language generation for spoken dialogue systems". In Proceedings of the 2000 ANLP/NAACL Workshop on Conversational Systems - Volume 3, ANLP/NAACL-ConvSyst '00.

[4] Adwait Ratnaparkhi. 2002. "Trainable approaches to surface natural language generation and their application to conversational dialog systems". Computer Speech and Language.

[5] Tsung-Hsien Wen, Milica Gasic, Dongho Kim, Nikola Mrksic, Pei-Hao Su, David Vandyke, and Steve Young. 2015. "Stochastic language generation in dialogue using recurrent neural networks with convolutional sentence reranking". In Proceedings of SIG-dial. Association for Computational Linguistics.

[6] Jeffrey Nichols, Jalal Mahmud, Clemens Drews. 2012. "Summarizing Sporting Events Using Twitter". IBM Research - Almaden

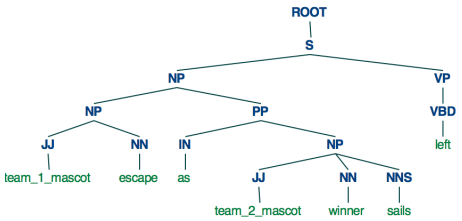

Fig. 1. PCFG example

[7] Chakrabarti, D., and Punera, K. 2011. “Event summarization using tweets”. Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media.