

# Dota2 Pre-game Prediction

## Prediction of Game Result and Game Duration

### Background

Defence of the Ancients 2 (Dota2) is a popular 5v5 MOBA game developed and published by Valve Corporation in 2011. In this game, there are two sides or teams, Radiant and Dire, and each team consists of five heroes. Both teams aim to destroy the opponent's ancient building and the victory belongs to the team which destroys the building first. Before the game starts, players in each team need to pick their heroes to be used in the game.

### Objective

This project aimed to investigate the effectiveness of Deep Learning in predicting the game result and the game duration using only pre-game data. Pre-game data only includes the hero draft picked by the two teams.

### Radiant



### Dire



### Methodology

Firstly, the data used in this project were collected through a third-party Application Programming Interface (API) and 181,717 matches were collected from 18 Jan 2020 to 26 Feb 2020. Data analysis was then conducted to investigate the influence of hero draft on game result and duration and feature engineering was also carried out to extract new features. Three models in total were built. The prediction result is either 0 or 1. 1 for Radiant Win and 0 for Dire win. 1 for duration above 35 minutes and 0 for the contrary.

### Feature Engineering

#### 1. Hero Vector

It is a vector  $x \in \mathbb{R}^{258}$  such that:

$$X_i = \begin{cases} 1 & \text{if Team Radiant has hero with id } i \\ 0 & \text{otherwise} \end{cases}$$

$$X_{i+129} = \begin{cases} 1 & \text{if Team Dire has hero with id } i \\ 0 & \text{otherwise} \end{cases}$$

#### 2. Synergy Difference

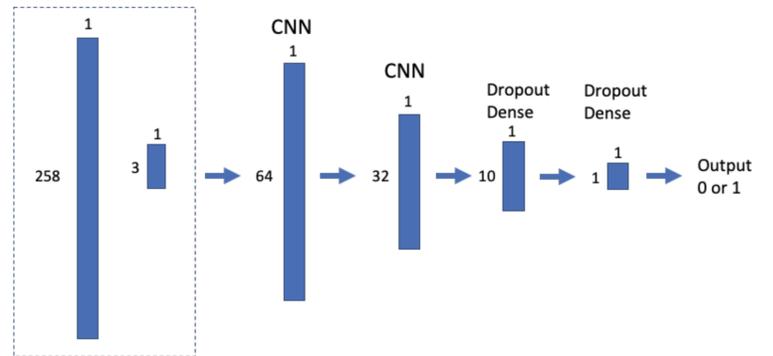
Synergy of Radiant is computed as  $S_R = \sum_{i \in R} \sum_{j \in R, i \neq j} S_{ij}$

Synergy of Dire is computed as  $S_D = \sum_{i \in D} \sum_{j \in D, i \neq j} S_{ij}$

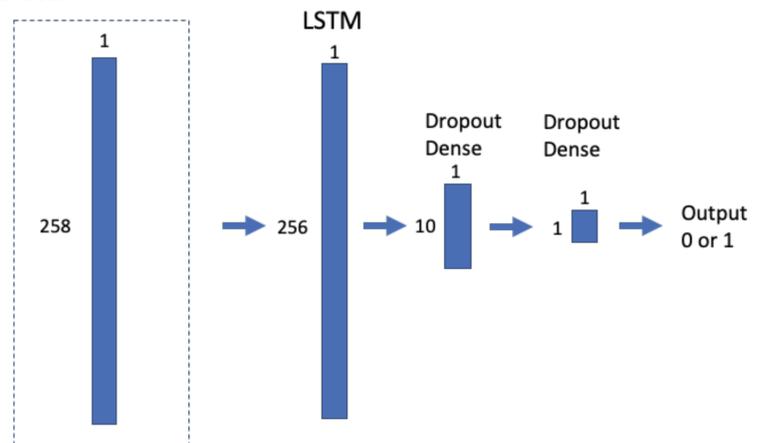
Synergy difference of two teams is computed as  $S_R - S_D$ .

### Models

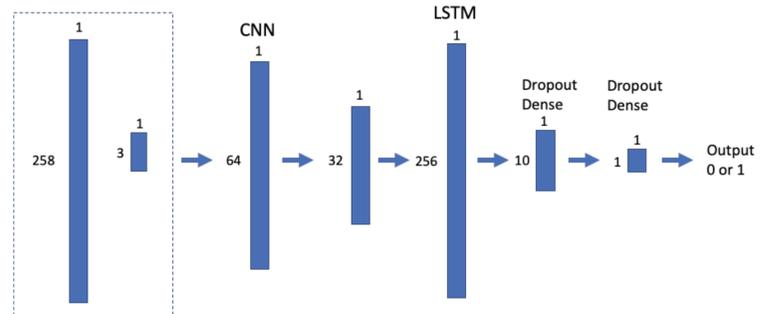
#### CNN



#### LSTM



#### CNN + LSTM



### Results

Game Result Prediction Accuracy  
**60.1%** (can be boosted to **67%**)

Game Duration Prediction Accuracy  
**59.6%**

#### 3. Radiant Counter

Counter effect of Radiant is computed as  $C_R = \sum_{i \in R} \sum_{j \in D} C_{ij}$   
As  $C_D = 25 - C_R$ , thus there is no need to compute  $C_D$ .

#### 4. Hero Role Distribution

Currently there are nine roles specified for heroes: **Carry, Nuker, Initiator, Disabler, Durable, Escape, Support, Pusher and Jungler.**

r_carry	r_nuker	r_initiator	r_disabler	r_durable	r_escape	r_support	r_pusher	r_jungler	d_carry	d_nuker	d_initiator	d_disabler	d_durable	d_esc:
0	2.0	4.0	3.0	5.0	1.0	4.0	4.0	0.0	0.0	1.0	4.0	2.0	3.0	0.0