# ANN MATCHMAKING IN LOL PROJECT

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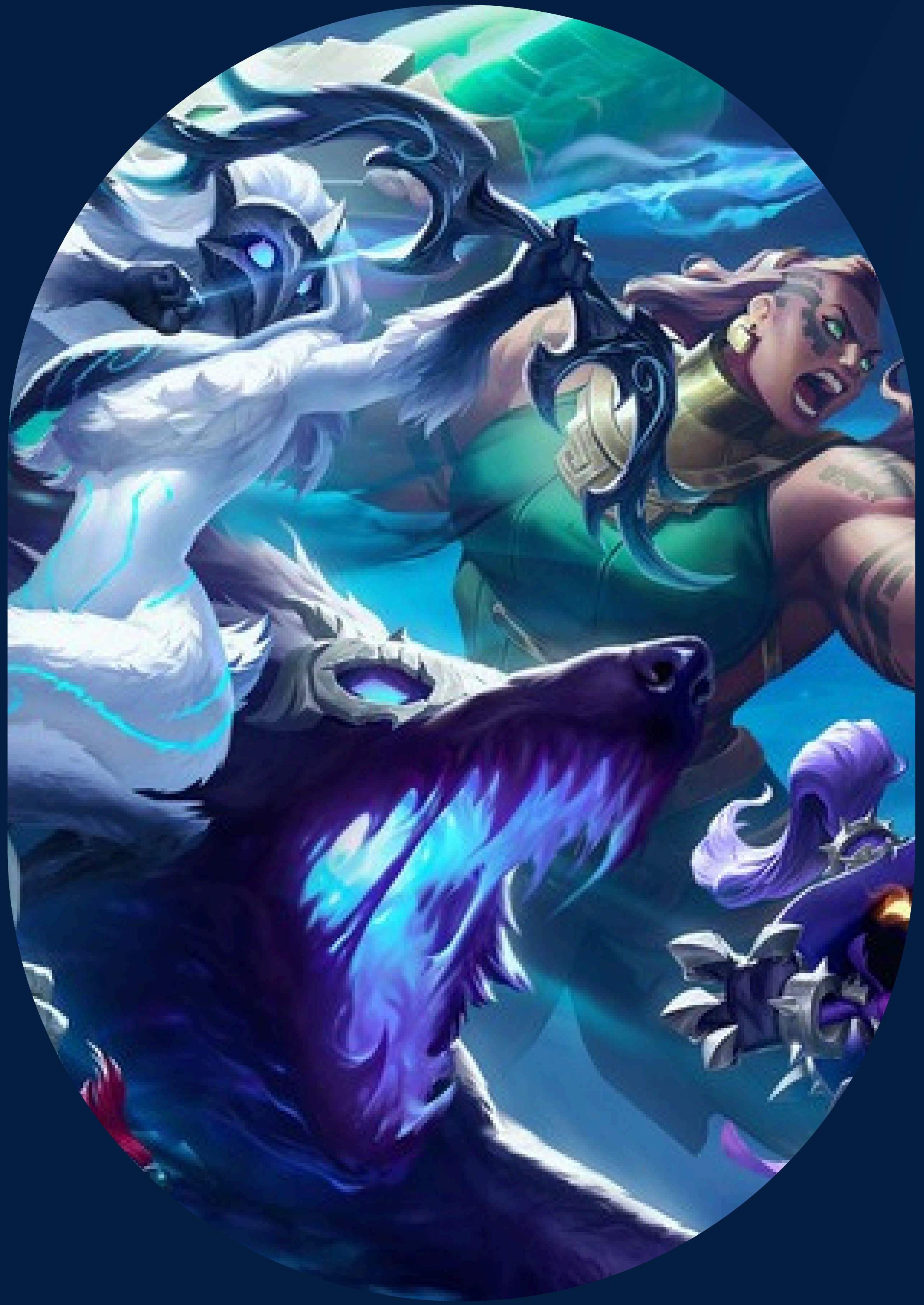


# TABLE OF CONTENTS

01 Overview

02 The Problem

03 Motivation

04 Methodology

05 Pipeline

06 KD Tree

07 Matching

08 Experiments

09 Results

10 Challenges

11 Future work

12 Thank you

# 01 OVERVIEW

01 League of Legends (LoL) is a multiplayer online battle arena game. Players are divided into two teams of five, competing to destroy the opponent's base while defending their own.

02 Matchmaking is the process of pairing players into teams based on factors like skill level, experience, and performance.

03 Our Goal
Develop and evaluate an ANN-based matchmaking system for League of Legends.

# 02 THE PROBLEM

**How can we improve matchmaking in competitive gaming using ANN models?**

## Challenges

### RUNTIME

Matchmaking system must handle large player populations without significant performance issues.

### MATCHMAKING

Balancing teams in a fair and competitive way. Main Challenge: Quantifying a “balance” match.

# 03 MOTIVATION

## Why it matters

A well-designed matchmaking system plays a crucial role in retaining players by minimizing wait times and ensuring balanced, competitive games. By creating an enjoyable and engaging experience, it encourages players to return and continue playing.

## Why ANN

- Fast Team Formation: Meets real-time matchmaking needs.
- Scalable: Handles large player datasets efficiently.
- Effective Approximation: Often better than exact matches for balanced games.

04

# METHODOLOGY

## DATA PREPARATION

Scraping players and games data
Data transformations and relevant analysis

## ANN MATCHMAKER

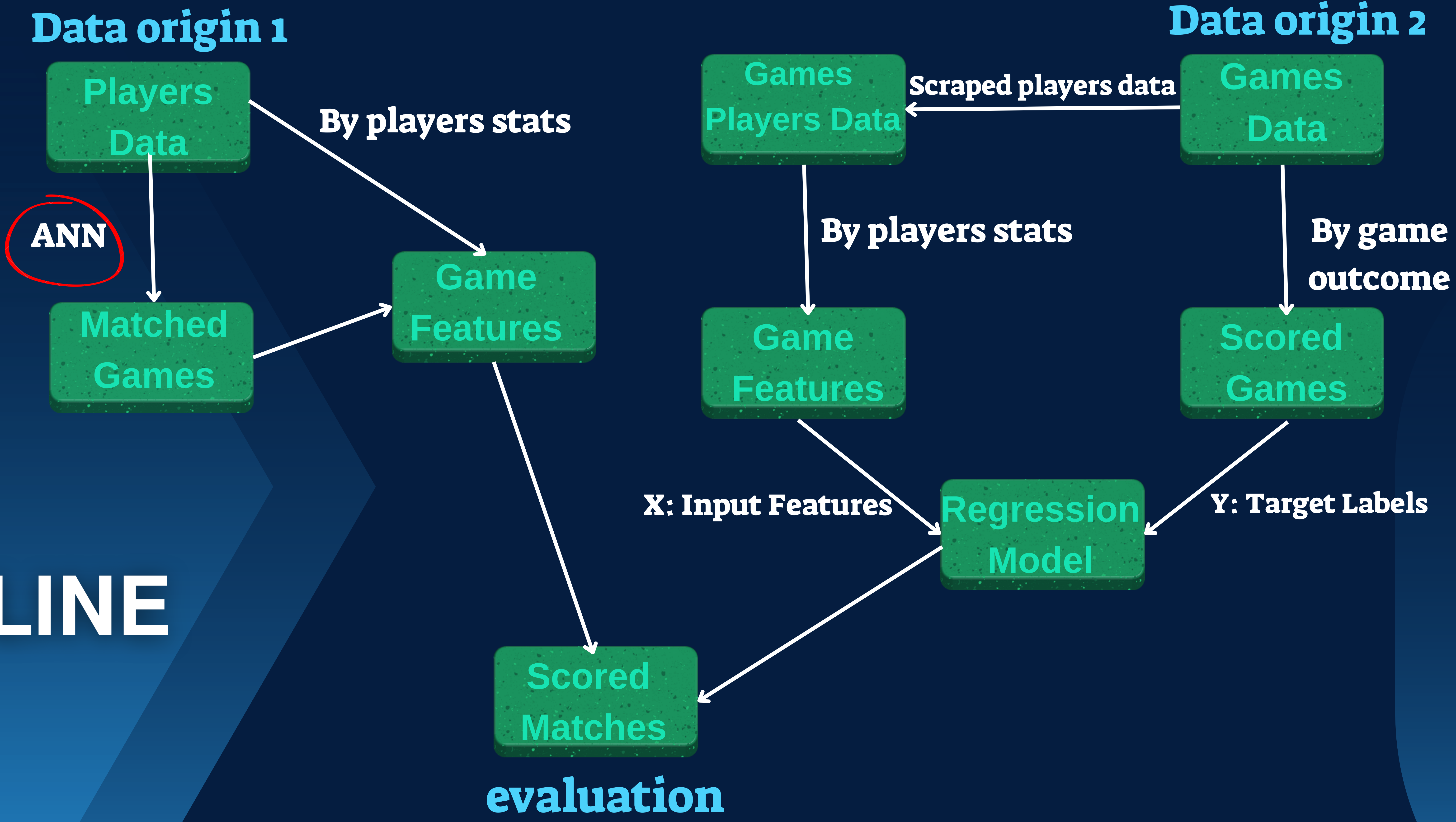
Organizing players into queues for 5 distinct roles
Clustering players into balanced teams

## EVALUATION

Calculating match features by player stats
Scoring games by outcomes (e.g. time, player scores)
Using regression model to predict game score based on player features

05

# PIPELINE



Data origin 1

Players Data

ANN

Matched Games

By players stats

Game Features

Scored Matches

evaluation

Data origin 2

Games Data

Scraped players data

Games Players Data

By players stats

Game Features

By game outcome

Scored Games

X: Input Features

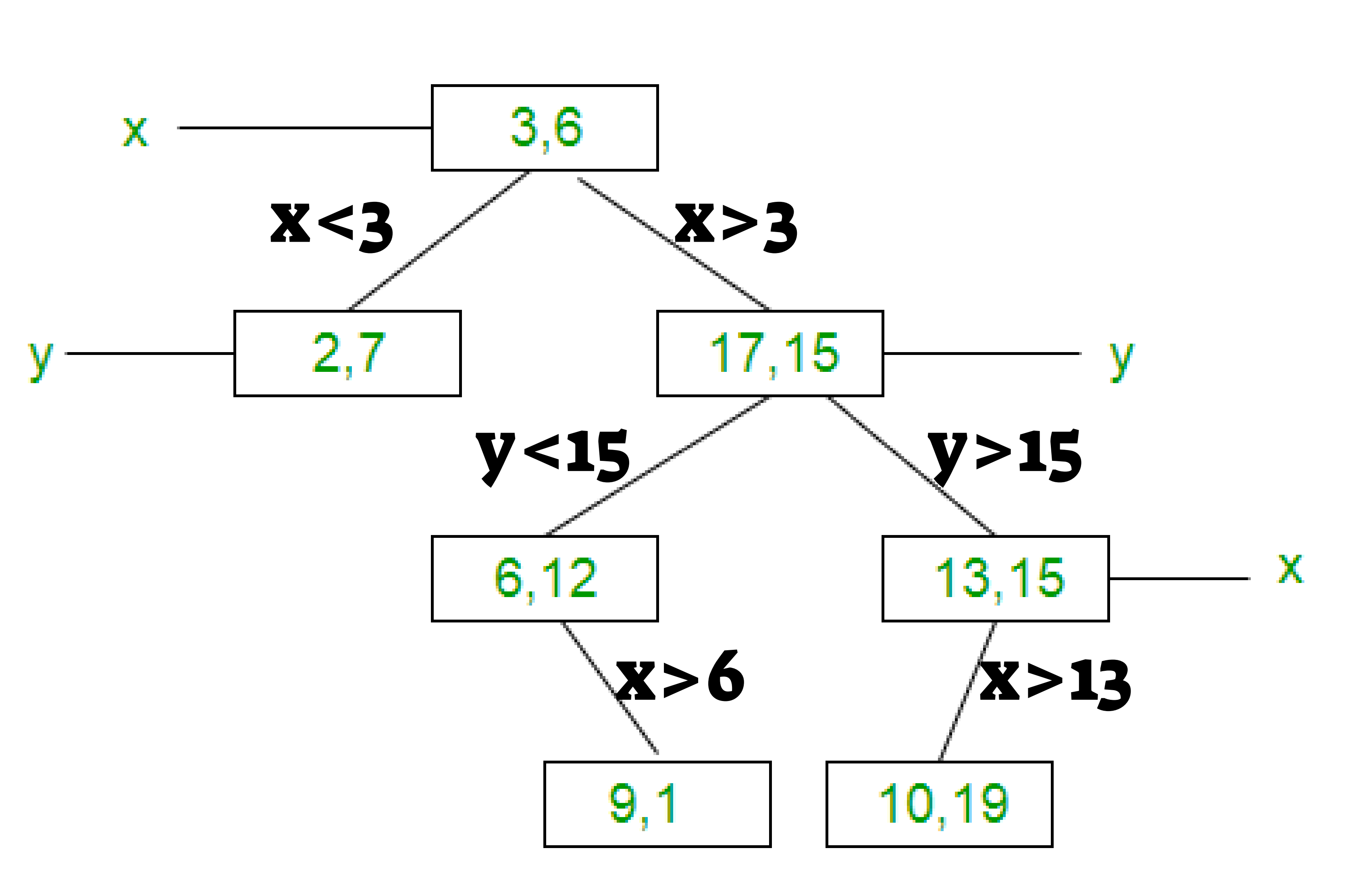
Regression Model

Y: Target Labels

# 06 KD TREES

A K-D Tree(aka K-Dimensional Tree) is a binary search tree where data in each node is a K-Dimensional point in space.

In short, it is a space partitioning data structure for organizing points.



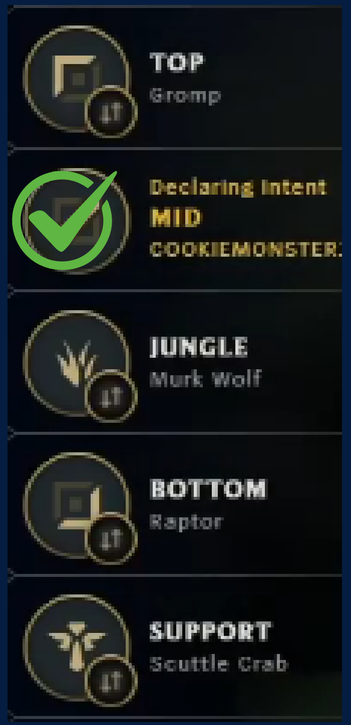
07

# MATCHING PROCESS

IVF alike

**We utilize a data structure called RoleQueue for each of the five roles, where each RoleQueue stores all players assigned to that role and maintains its own Kd-Tree.**

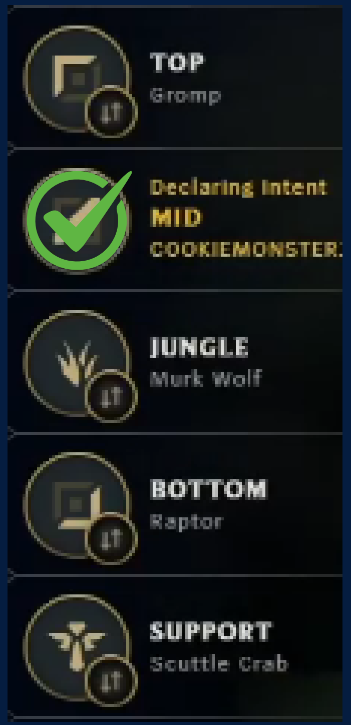
**Team 1**



random first player

**Mid Queue**

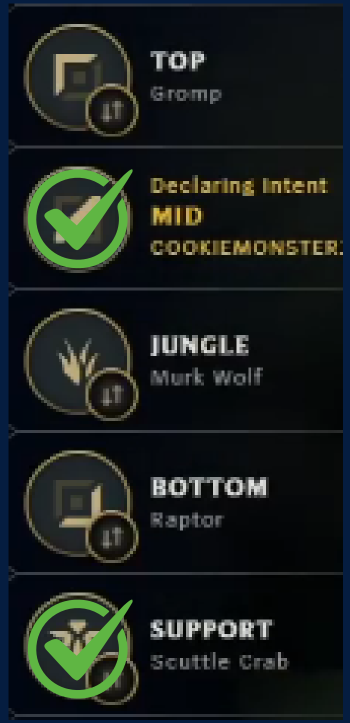
**Team 2**



ANN to first Team1 player vec

**Mid Queue**

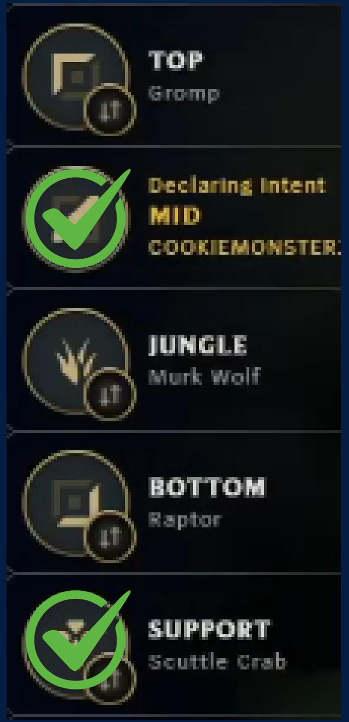
**Team 1**



Ann to avg Team 1 vec

**Support Queue**

**Team 2**



Ann to second Team 1 player vec

**Support Queue**

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⚠ Once we gather 10 players, a balance check is conducted before finalizing the match.

08

# KEY EXPERIMENTS

**ANN Variations:**

- Tested different feature subsets

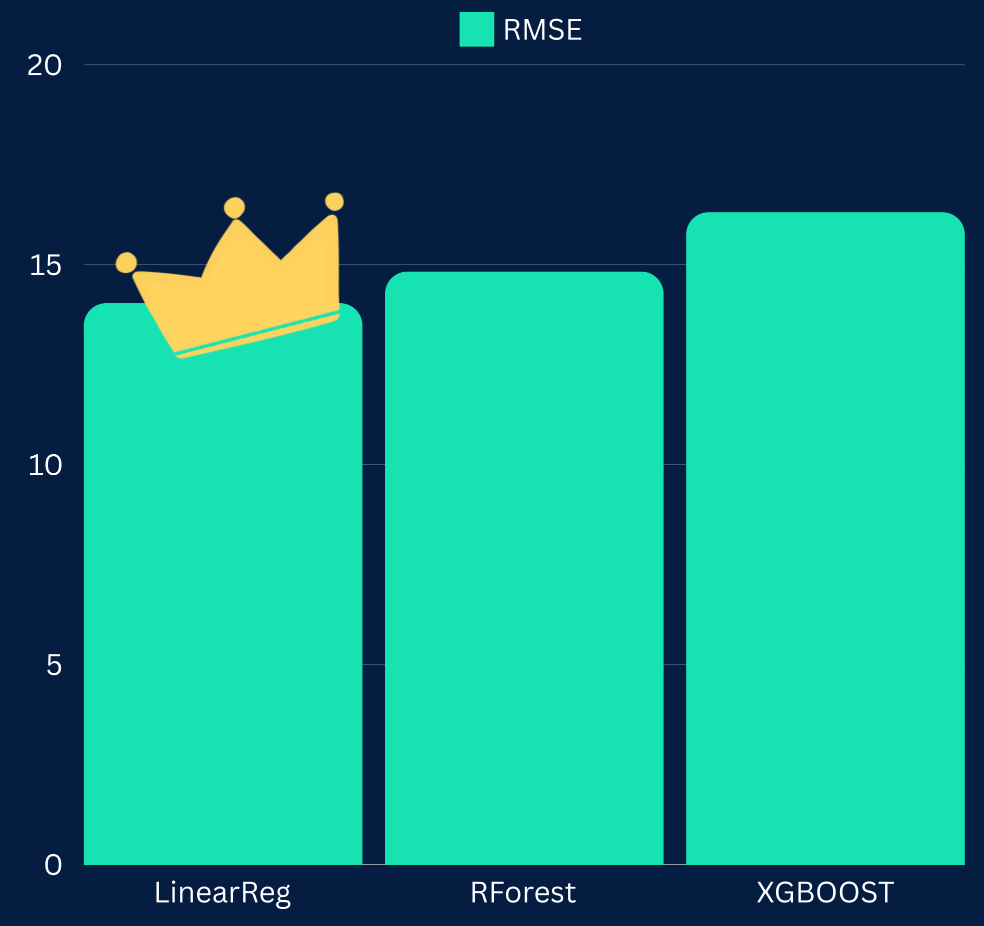
**Regression Model:**

- Used AIC for feature selection and tested multiple regression techniques.
- Explored residual plots for model insights.

**Metrics:**

- Evaluated game scores (outcomes) by balancing features and integrating domain knowledge.
- Analyzed match features across individual, team, and cross-team statistics.

Model Performance (RMSE)



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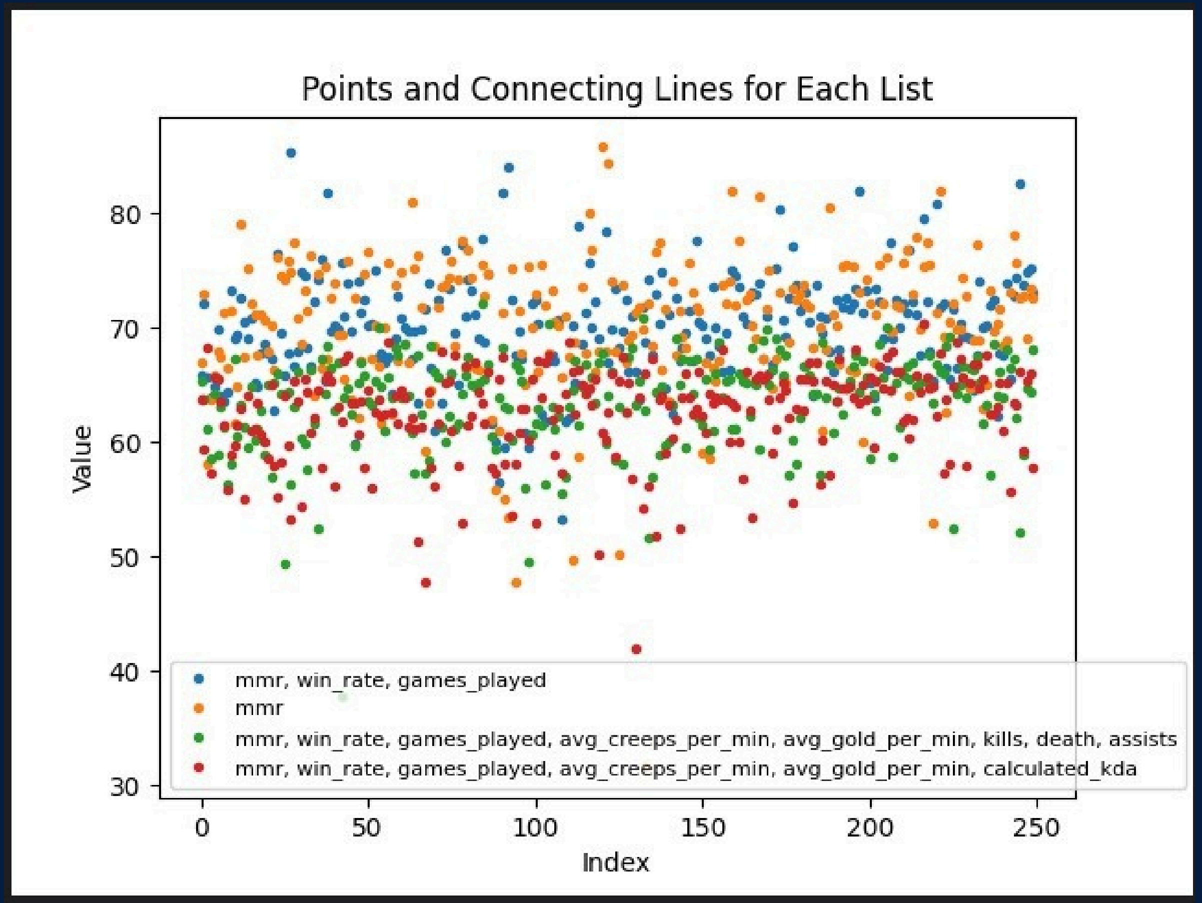
# RESULTS AND INSIGHTS

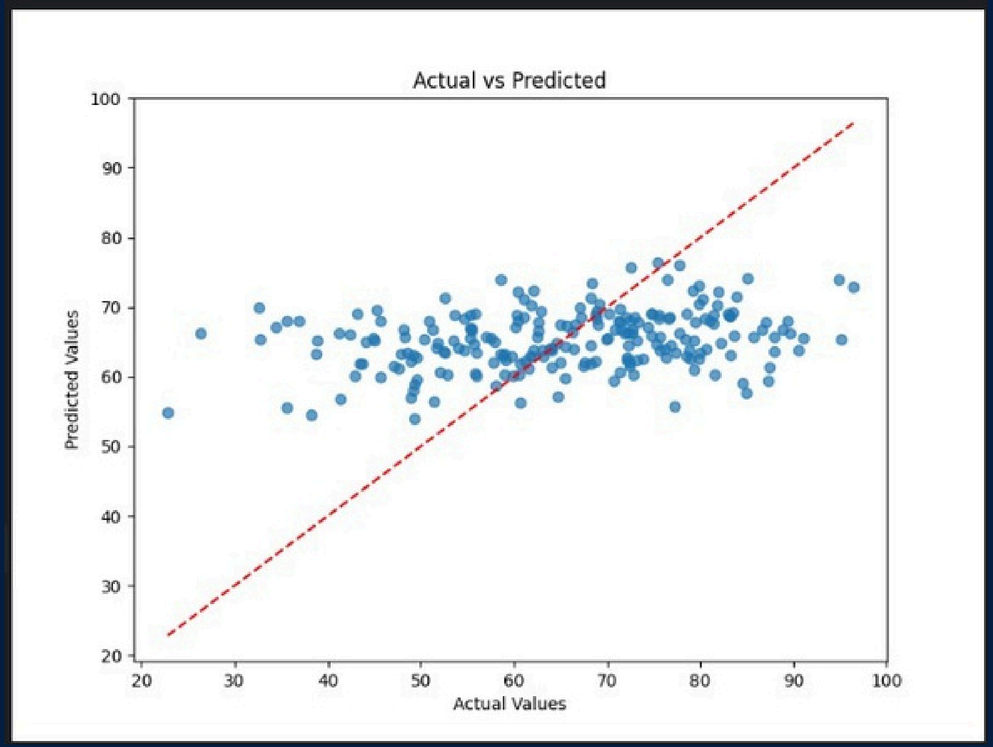


## GRAPHS:

The following graph represents our main results. For each feature subset, we performed matchmaking until 250 matches were achieved. The graph shows the predicted quality of each match, with higher points indicating better feature selection and improved performance of the ANN model.

## KEY TAKEAWAYS:

- ANN approach works but needs further fine-tuning.
- Regression model struggled to predict balance scores.



# 10 CHALLENGES

- **Defining an effective metric** for game score and validating its accuracy in representing game balance.
- Working with a **small games dataset**, which posed challenges for accurately predicting game scores.
- **Relying on player and team statistics as features** for matchmaking, despite the complexity and nuances of real-world gameplay dynamics.
- **Limited time** constraints prevented us from exploring and implementing additional ANN methods.
- **Embedding players and games** using normalized feature vectors, even though certain features should carry more or less weight in their representation.
- **Handling data preprocessing** and feature engineering while ensuring they align with the matchmaking process.

11

# FUTURE WORK

ANN Improvement:

- Test more algorithms for clustering.

Better Metrics:

- Explore alternative balance scoring methods.

Model Refinements:

- Improve regression accuracy with advanced models.

## 12 THANK YOU

### CONNECT WITH US.

github: ANN_LOL_Matchmaking

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