## DATABASE MANAGEMENT SYSTEM

# CTF

A RealTime Ranking Capture the Flag event.

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# Abstract

Our project will look towards building a real time ranking system, which will be a platform for people to solve cryptographic problems and compete amongst each other at the same time

# Objectives

- To build a Real time ranking portal for competition platform.
- Implementing a NoSQL database using MongoDB

# Objectives

- To use research papers to solve the problems occuring while implementing this project
- To finalize the drawbacks and advantages of such a system.

# Motivation

## INITIAL THOUGHT

Being relatively new, we decided it would be better if we learnt and tried to implement the same in a fun way.

## IS IT REQUIRED?

It would serve as an excellent platform for people to host online competitions.

## WOULD IT HELP?

Introduce people to CTFs (Capture the Flag), which are essentially information security competitions.

# WHY THIS ?

## AN ONLINE COMPETITION PLATFORM?

- Since our project is supposed to be based on competing and solving InfoSec problems, there was a need to have a real time ranking system to make the game more competitive and lively.
- Hence, we searched for papers related to real time ranking and competition.
- This paper gave us an insight into the methods used, research approach and algorithms


Paper 1-
ELO and
Matchmaking
1
ONLINE MATCHMAKING
2
BUILDING A RANKING SYSTEM
3
WEB INTERFACE SYSTEM
4
ELO ALGORITHMS

# Paper 1 Feature Highlights

## ELO SYSTEM

Depending on players' win loss ratio-score decreases or increases

## ONLINE LADDER APPROACH

A 400 point difference in the ELO system results in a higher than 96% win expectancy, increasing exponentially..

## RESEARCH APPROACH

Proper experiments have been done and proved in these papers

## IMPLEMENTING MIDDLEWARE DESIGN

Pipeliines and architecture used for ranking are discussed here

# Paper 2- Skill level

1. EXAMINE PERFORMANCE RESPONSE OF COMPETITORS
2. BUILDING ON THE THEORETICAL FRAMEWORK OF RANK (MOLDOVANU & SELA
3. LOWER RESPONSE OF PAYERS WITH INCREASING NUMBER OF PARTICIPATION
4. COMPARISIONS WITH OTHER PLATFORM

# Paper 2 Feature Highlights

Let X ={FA,δ,V,n} be atournament. Then, the unique, symmetric, equilibrium bid function, where Pj,n(z) is the probability of ranking jth in ability among n competitors, is

$$b(a) = \sum_{j=1}^{p} V_j \int_0^a \frac{1}{\delta(z)} \frac{\partial P_{j,n}}{\partial a}(z) dz.$$

where n is a baseline number of competitors, k is an incremental addition to the number of competitors, and the error term is redefined appropriately as δ

$$\Delta_{n,n+k} g(SkillRating_{it} | \overline{SkillRating}_{it}) = \frac{g(n+k, SkillRating_{it}, \overline{SkillRating}_{it}) - g(n, SkillRating_{it}, \overline{SkillRating}_{it})}{k} + \delta_{it},$$

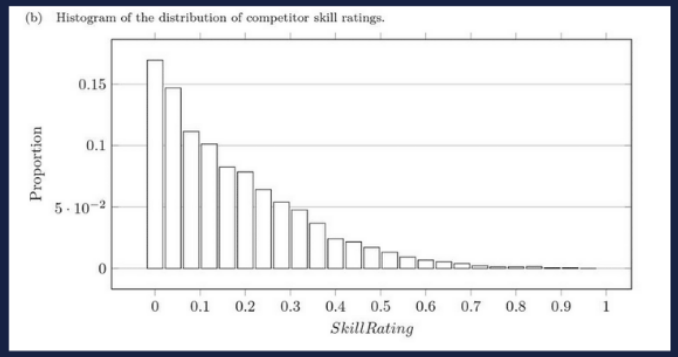
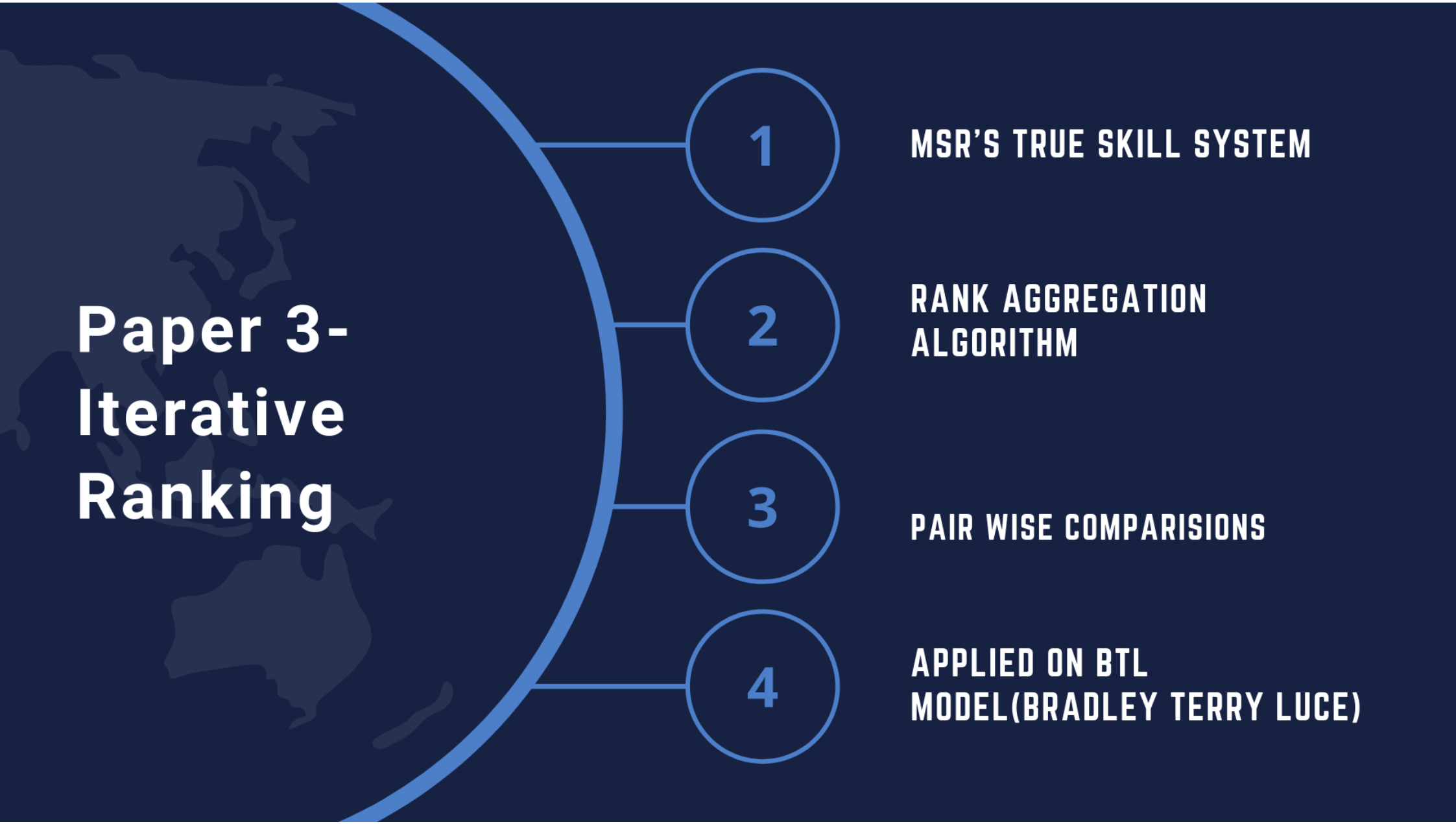



**TABLE 1 Summary Statistics of Estimation Variables**

| Notation | Theoretical Counterpart | Variable Description | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| *Score* | $b$ | Final score in a competition. | 271.09 | 274.22 | 0.00 | 1722.00 |
| *SkillRating* | $a$ | TopCoder rating. | 0.20 | 0.16 | 0.01 | 0.99 |
| $\overline{SkillRating}$ | $F_A$ | Mean of the TopCoder ratings in the competition room. | 0.20 | 0.04 | 0.05 | 0.37 |
| $N$ | $n$ | Number of competitors in the competition room. | 18.66 | 1.08 | 15.00 | 20.00 |

# Paper 3- Iterative Ranking



# Paper 3 Feature Highlights

## RANDOM WALK APPROACH

A pointer walks over randomnly on a matrix and assigns weghts to each block

$$P_{ij} = \begin{cases} \frac{1}{d_{\max}} A_{ij} & \text{if } i \neq j \ , \\ 1 - \frac{1}{d_{\max}} \sum_{k \neq i} A_{ik} & \text{if } i = j \ . \end{cases}$$

## ERROR BOUND IN STATIONARY DISTRIBUTIION

Prsesnts ourr main recovery theorem under the sampling assumptions discussed

# ALGORITHMS AND TECHNIQUES

## BEST ONES FROM ALL PAPERS

### RANDOM WALK APPROACH

A pointer walks over randomnly on a matrix and assigns weghts to each block

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# INNOVATIVE IDEAS USED

## MORE FEATURES!

Real Time Ranking

Transparency in points system

Introduce students to Info-Sec community

PRODUCTIVITY BEGINS TODAY!

# References


1. FRITSCH, TOBIAS & VOIGT, BENJAMIN & SCHILLER, JOCHEN. (2019). THE NEXT GENERATION OF COMPETITIVE ONLINE GAME ORGANIZATION.

2. BOUDREAU, K. J., LAKHANI, K. R. AND MENIETTI, M. (2016), PERFORMANCE RESPONSES TO COMPETITION ACROSS SKILL LEVELS IN RANK-ORDER TOURNAMENTS: FIELD EVIDENCE AND IMPLICATIONS FOR TOURNAMENT DESIGN. THE RAND JOURNAL OF ECONOMICS, 47: 140-165. DOI:10.1111/1756-2171.12121

3. NEGAHBAN, SAHAND AND OH, SEWOONG AND SHAH, DEVAVRAT, ITERATIVE RANKING FROM PAIR-WISE COMPARISONS, CURRAN ASSOCIATES, INC. (2012)