

# Go game winner prediction

Andrii Roiko

*Data-Focused Programming Bootcamp  
InoXoft*

*roykoand@gmail.com*

December 13, 2021

# Content

- 1 Go game
- 2 Problem definition
- 3 Dataset
- 4 Augmentation
- 5 Model
- 6 Flask app
- 7 API
- 8 Links

# What is the Go/Weiqi/Baduk



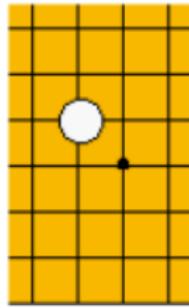
Sakata Kintoki, Usui Sadamitsu, and Watanabe no Tsuna subdue monsters while playing go-game. Utagawa Kuniyoshi, 1861

# How to score a Game of Go

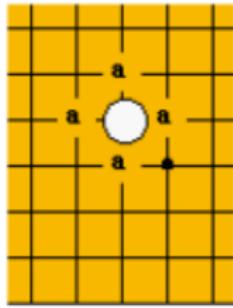
Simplified formula of the total score (by Japanese rules):

$$\text{Total score} = \mathbf{\text{Prisoners}} + \dots$$

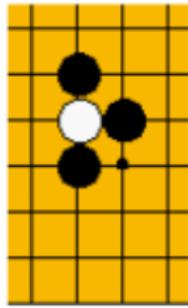
# Prisoners



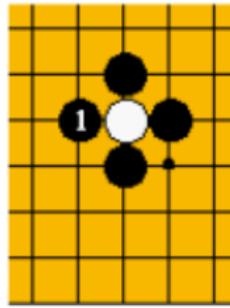
Dia. 3



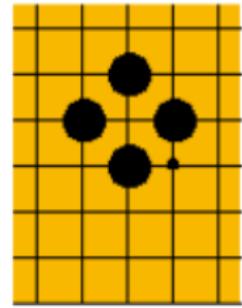
Dia. 4  
liberties



Dia. 5  
atari



Dia. 6  
capture



Dia. 7  
result

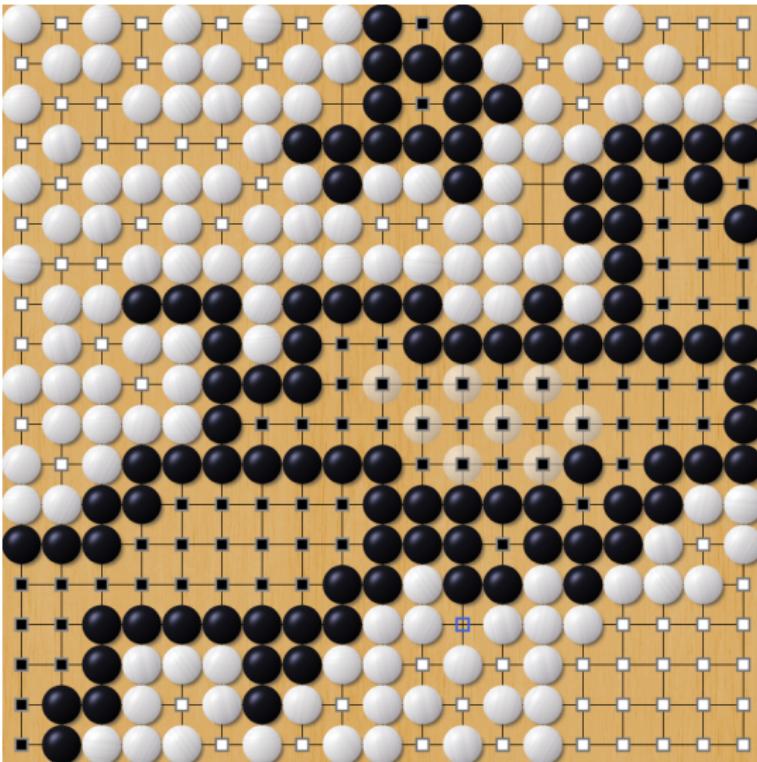
Image was stolen from <https://www.kiseido.com/ff.html>

# How to score a Game of Go

Simplified formula of the total score (by Japanese rules):

$$\text{Total score} = \text{Prisoners} + \mathbf{\text{Empty points}} + \dots$$

# Empty Points



Screenshot was made on <https://online-go.com>

# How to score a Game of Go

Simplified formula of the total score (by Japanese rules):

$$\text{Total score} = \text{Prisoners} + \text{Empty points} + \mathbf{\text{Komi}}$$

# Content

1 Go game

2 Problem definition

3 Dataset

4 Augmentation

5 Model

6 Flask app

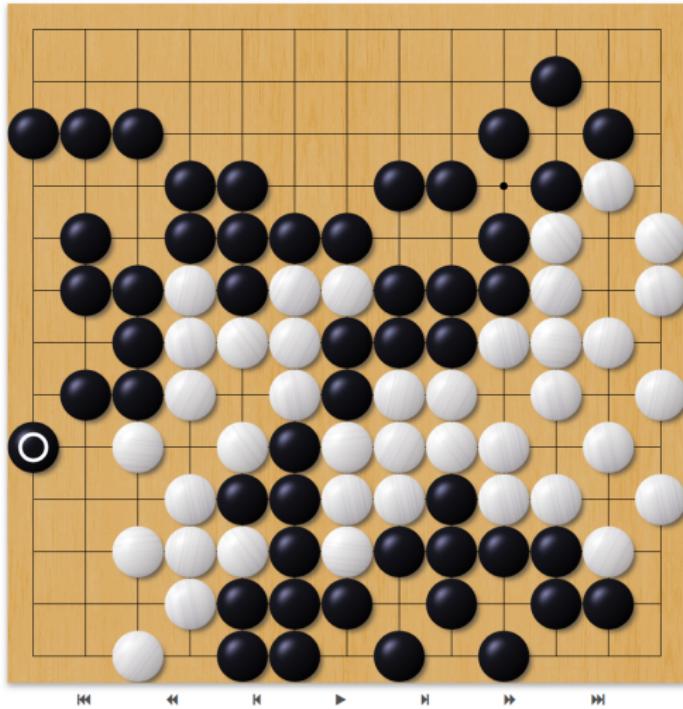
7 API

8 Links

# Project goal



Home Play Games Chat Puzzles Joseki Tournaments Ladders Groups Leaderboards Forums Profile



Move 105

Screenshot was made on <https://online-go.com>



# Content

- 1 Go game
- 2 Problem definition
- 3 Dataset
- 4 Augmentation
- 5 Model
- 6 Flask app
- 7 API
- 8 Links

## Example of sgf file

```
(;GM[1] FF[4] SZ[19] PW[vitality] WR[6d]
PB[Zeratul] BR[6d] DT[2008-12-05]
PC[The KGS Go Server at http://www.gokgs.com/]
KM[6.50] RE[W+12.50] RU[Japanese] CA[UTF-8] ST[2]
AP[CGoban:3] TM[60] OT[5x10 byo-yomi];
B[pd];W[dd];B[dp];W[pp];B[nq];W[qn];B[fc];W[hc];
B[cf];W[fd];B[cc];W[ec];B[cd];W[lq];B[fq];W[nc];
B[qf];W[pb];B[qc];W[ld];B[pq];W[qq];B[qr];W[oq];
B[pr];W[op];B[qp];W[rq];B[rp];W[rr];B[];W[])
```

## Example of sgf file

```
(;GM[1] FF[4] SZ[19] PW[vitality] WR[6d]
PB[Zeratul] BR[6d] DT[2008-12-05]
PC[The KGS Go Server at http://www.gokgs.com/]
KM[6.50] RE[W+12.50] RU[Japanese] CA[UTF-8] ST[2]
AP[CGoban:3] TM[60] OT[5x10 byo-yomi];
B[pd];W[dd];B[dp];W[pp];B[nq];W[qn];B[fc];W[hc];
B[cf];W[fd];B[cc];W[ec];B[cd];W[lq];B[fq];W[nc];
B[qf];W[pb];B[qc];W[ld];B[pq];W[qq];B[qr];W[oq];
B[pr];W[op];B[qp];W[rq];B[rp];W[rr];B[];W[])
```

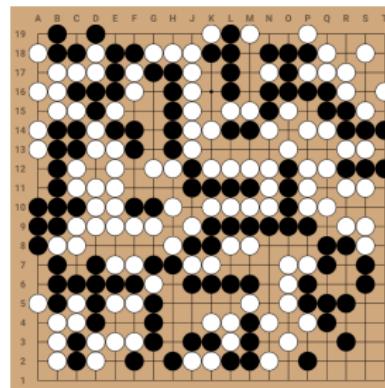
# SGF2PNG

sgf2png utility: <https://github.com/julianandrews/sgf-render>

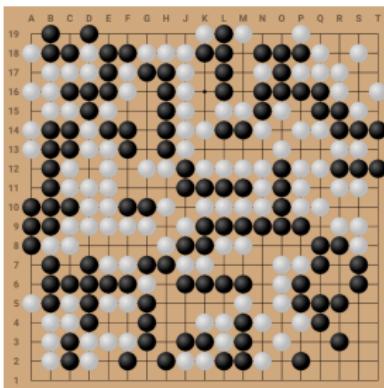
Dataset link: <https://bit.ly/31Urm46>

Total number of images: 30k [15k per class]

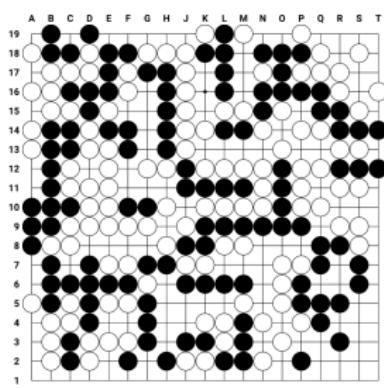
Go board styles



Default board



Gradient stones

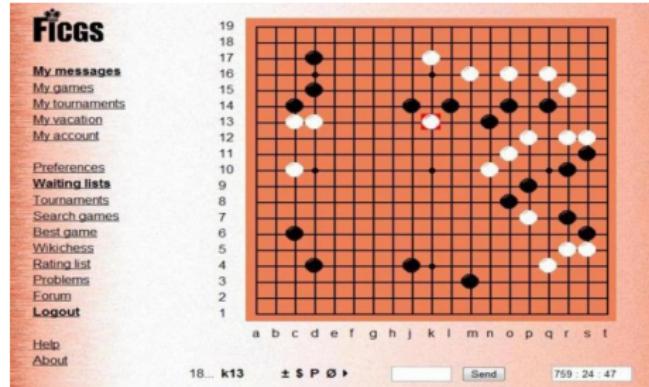


White-black board

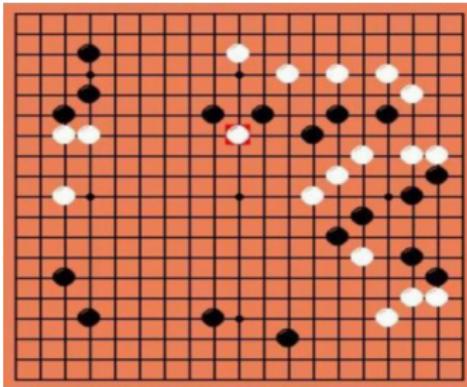
# Content

- 1 Go game
- 2 Problem definition
- 3 Dataset
- 4 Augmentation
- 5 Model
- 6 Flask app
- 7 API
- 8 Links

# Types of input data



Go board with background



Go board without background

# Augmentation

The image shows a screenshot of the online-go.com game interface. At the top, there's a navigation bar with links for Home, Play, Games, Chat, Puzzles, Joseki, Tournaments, Ladders, Groups, Leaderboards, Forums, and Profile. The main area features a Go board with a light wood texture and a 19x19 grid. The board has columns labeled A through J and rows labeled 1 through 9. There are several white and black stones placed on the board, particularly in the center and upper-middle sections. To the right of the board is a toolbar with various icons for editing and viewing. Below the board is a message input field with a green 'Back to Game' button and a 'Pass' button. On the far right, there's a vertical sidebar with more game-related icons. The bottom right corner shows a small preview of the board with numbered moves (40, 44, 48) and a 'Move 47' indicator. The bottom of the screen has standard browser controls like back, forward, and search.

Game Finished | Facebook | [online-go.com/game/36262785](https://online-go.com/game/36262785)

Home Play Games Chat Puzzles Joseki Tournaments Ladders Groups Leaderboards Forums Profile 27:15 0 10

A B C D E F G H J

9 8 7 6 5 4 3 2 1

9 8 7 6 5 4 3 2 1

A 1 △ □ ○ ×

Back to Game Pass

see? Therefore you dont have terri Share

WASN'T CLOSED

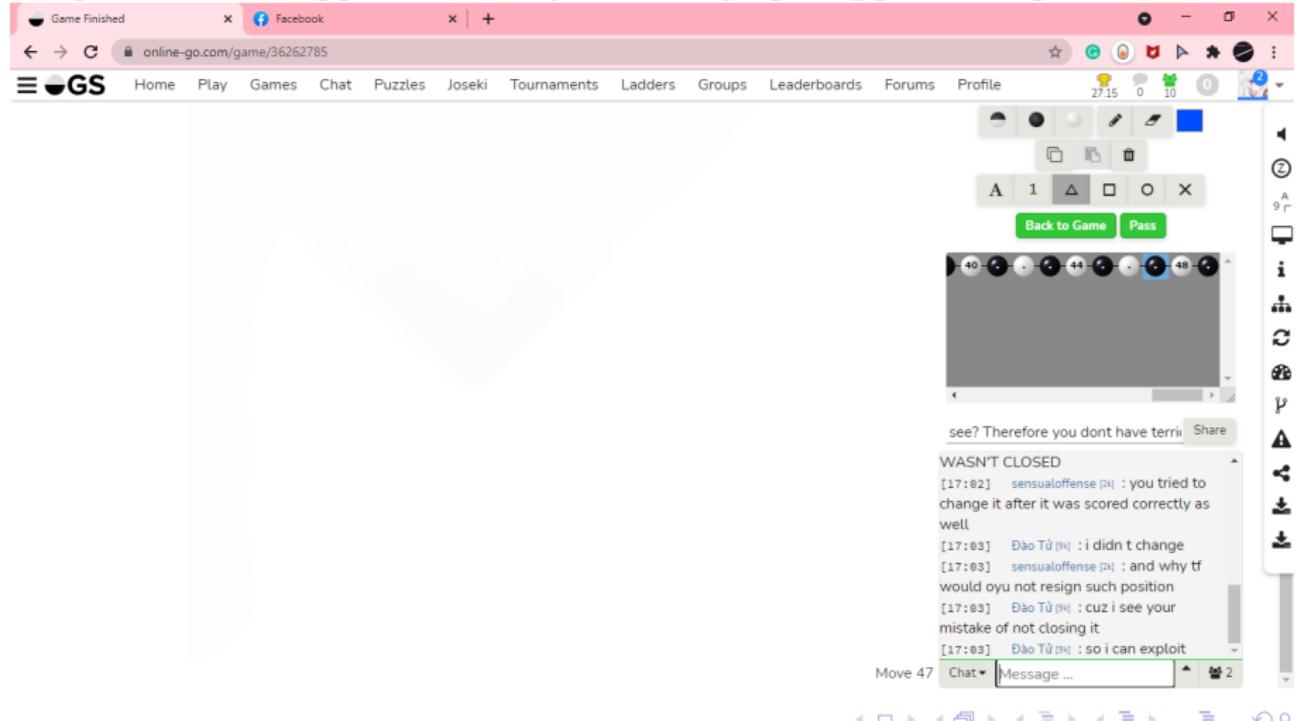
[17:02] sensualoffense [PI] : you tried to change it after it was scored correctly as well  
[17:03] Đào Tử [PI] : i didn't change  
[17:03] sensualoffense [PI] : and why tf would oyu not resign such position  
[17:03] Đào Tử [PI] : cuz i see your mistake of not closing it  
[17:03] Đào Tử [PI] : so i can exploit

Move 47 Chat Message ... 2

# Augmentation

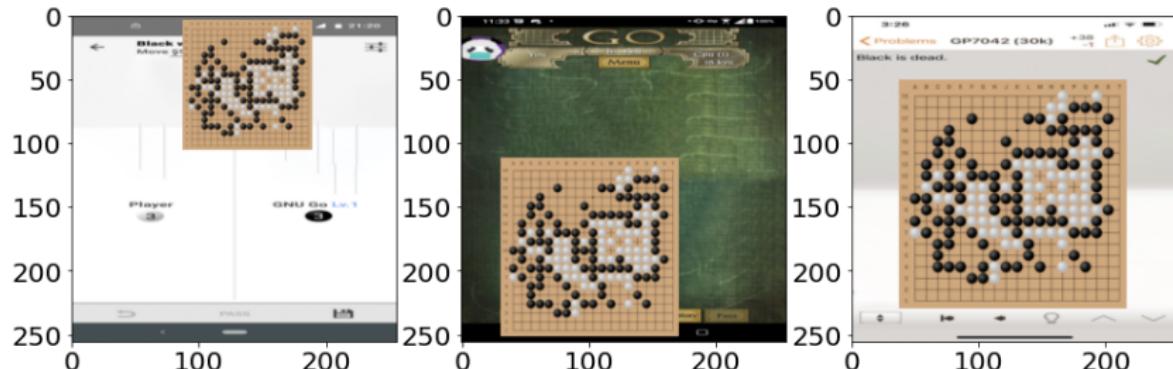
Backgrounds dataset:

<https://www.kaggle.com/roykoandriy/go-apps-backgrounds>



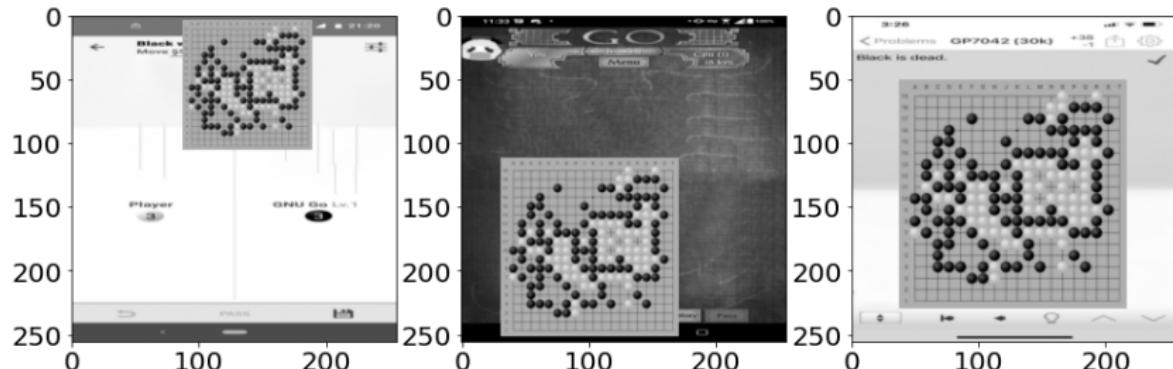
# Augmentation

Example of augmentation on different backgrounds:



# Augmentation

Example of augmentation on different backgrounds:



# Content

- 1 Go game
- 2 Problem definition
- 3 Dataset
- 4 Augmentation
- 5 Model
- 6 Flask app
- 7 API
- 8 Links

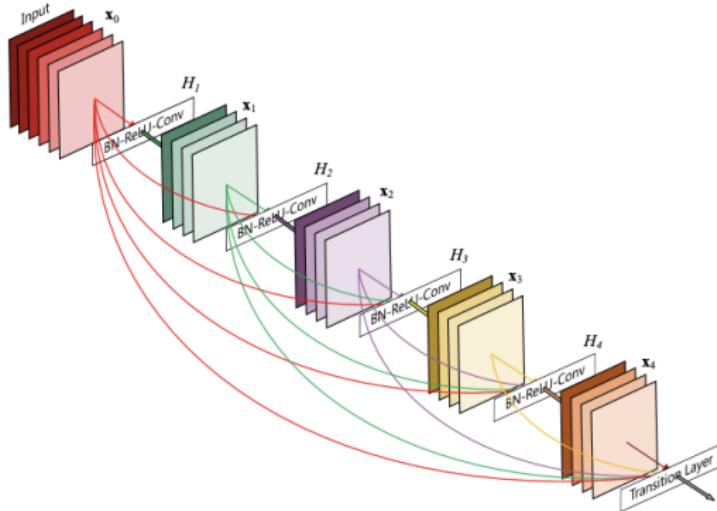
# Optimization parameters and loss function

Loss function: Cross entropy

Optimizer: Adam (learning rate =  $3 \cdot 10^{-4}$ )

Learning rate scheduler: ReduceLROnPlateau

# DenseNet 121



DenseNet models architecture

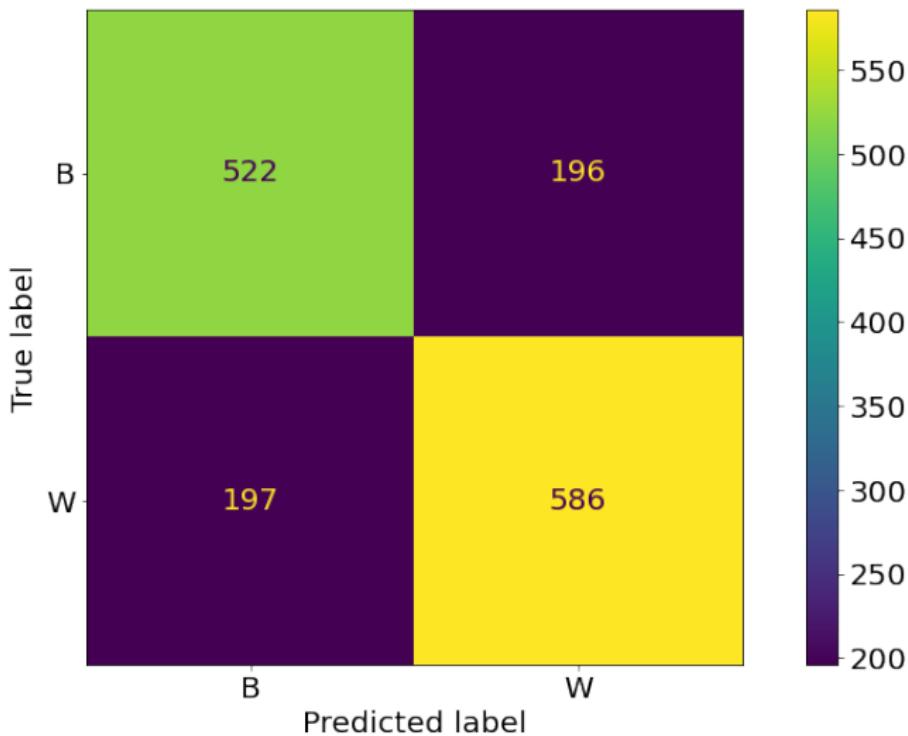
Densely Connected Convolutional Networks  
[<https://arxiv.org/abs/1608.06993>]

# Metrics on the test dataset

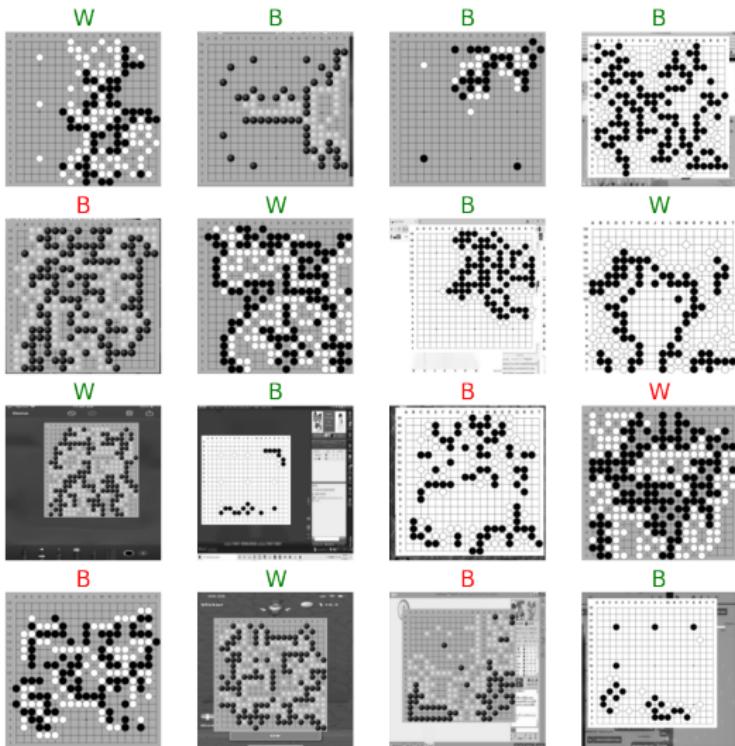
Metric name	Score (percents)
Accuracy	73.9
Balanced accuracy	73.9
F1	74.7
Precision	75.3
Recall	74.2

\*Test dataset metrics vary depending of the splitting

# Confusion matrix on the test dataset



# Predictions on the test dataset



# Content

1 Go game

2 Problem definition

3 Dataset

4 Augmentation

5 Model

6 Flask app

7 API

8 Links

# Flask app

Path of the flask app in repository:  
GoWinnerPrediction/app

# Content

- 1 Go game
- 2 Problem definition
- 3 Dataset
- 4 Augmentation
- 5 Model
- 6 Flask app
- 7 API
- 8 Links

# Go winner prediction API

```
$ curl -X GET http://127.0.0.1:5000/?url=<URL_TO_THE_IMAGE>
{
    "prediction": "<COLOR_OF_THE_WINNER>" ,
    "url": "<URL_TO_THE_IMAGE>"
}
```

# Content

- 1 Go game
- 2 Problem definition
- 3 Dataset
- 4 Augmentation
- 5 Model
- 6 Flask app
- 7 API
- 8 Links

# Links

Github repo: <https://github.com/roykoand/GoWinnerPrediction>  
This presentation in GoWinnerPrediction/demo/presentation  
For inspiration (AlphaGo Documentary movie):  
<https://youtu.be/WXuK6gekU1Y>

The end :)

My contacts:

- Gmail: roykoand@gmail.com

- Telegram: @roykoand

- Github: <https://github.com/roykoand>

- LinkedIn:

<https://www.linkedin.com/in/roiko-andrii-3b330518a/>