



IMAGE2CODE

5/Jun/2019



CONTENTS

What is this?

Problem Statement

Progress

Current Results

WHAT IS THIS?

User Scenario 1



Let's make a
FANCY
website!!!

John – Designer

Know nothing about coding



Why not? You
aren't the one
who writes code

Bob – Web Developer

Care about nothing except coding

WHAT IS THIS?

User Scenario 1



This is my
genius design !!!

John – Designer

Know nothing about coding

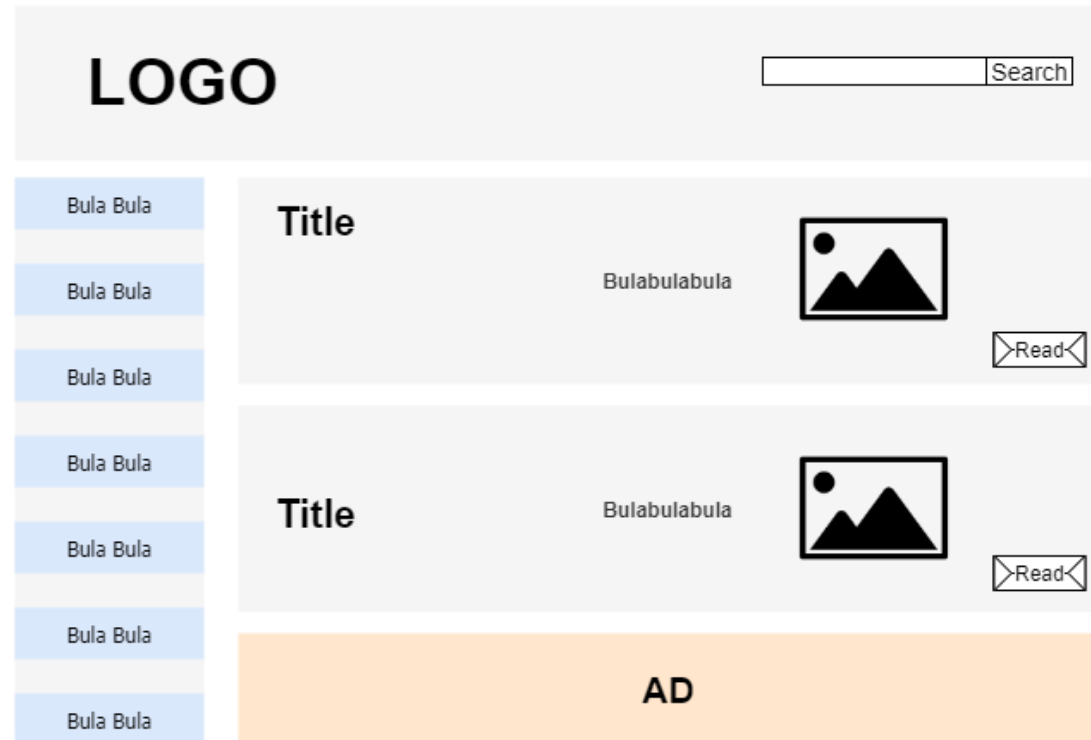


Image Prototype

WHAT IS THIS?

User Scenario 1



Bob – Web Developer

Care about nothing except coding

Okay, I will spend four days to transform this into code

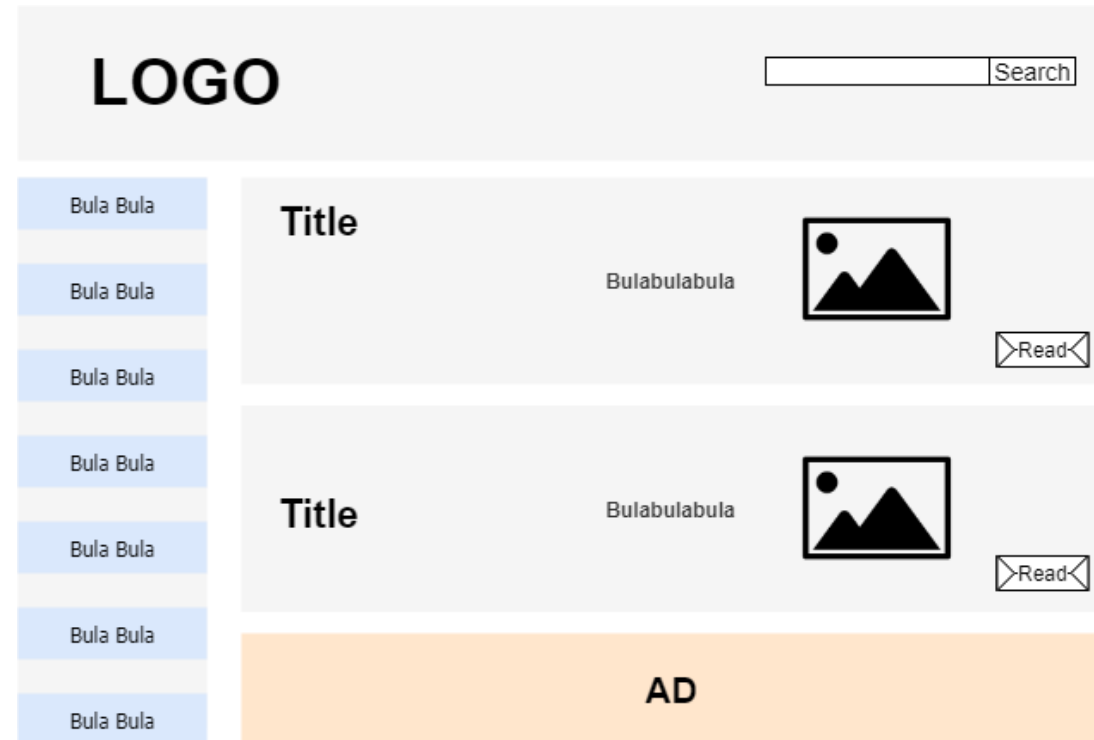


Image Prototype

WHAT IS THIS?

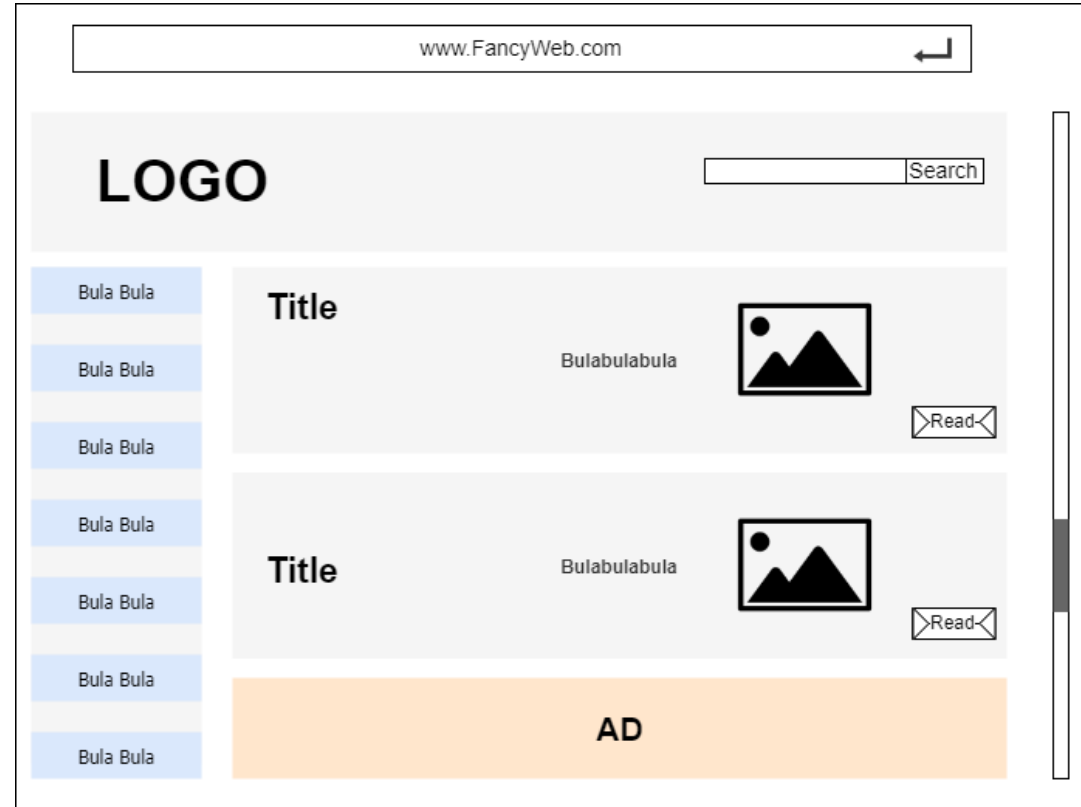
User Scenario 1



Bob – Web Developer

Care about nothing except coding

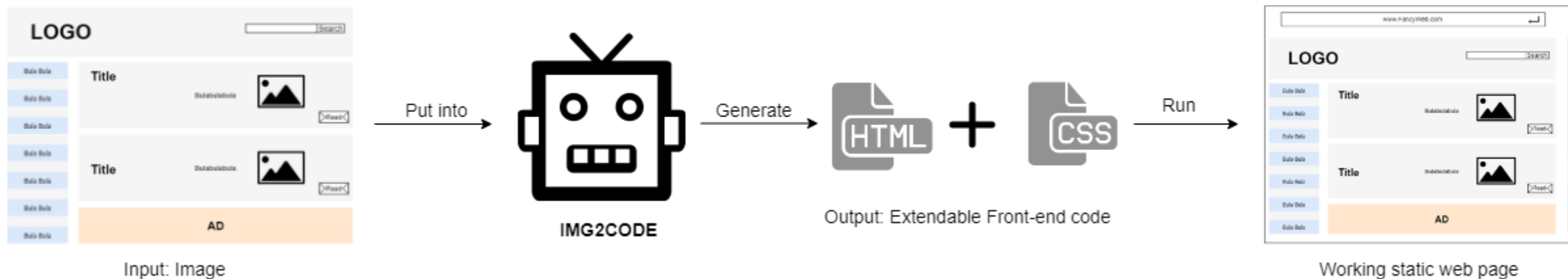
OR, I can take several
SECONDS to do so by
using the
IMG2CODE



Working Static Webpage

WHAT IS THIS?

User Scenario 1: Image Design to Code



WHAT IS THIS?

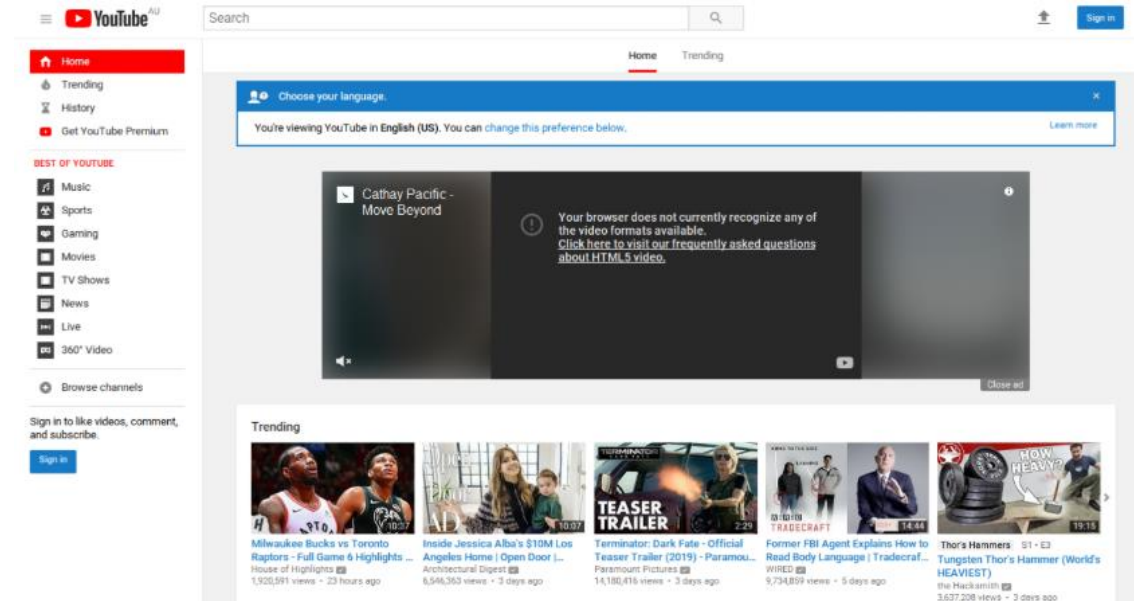
User Scenario 2



Let me check Youtube

Bob – Web Developer

Care about nothing except coding



WHAT IS THIS?

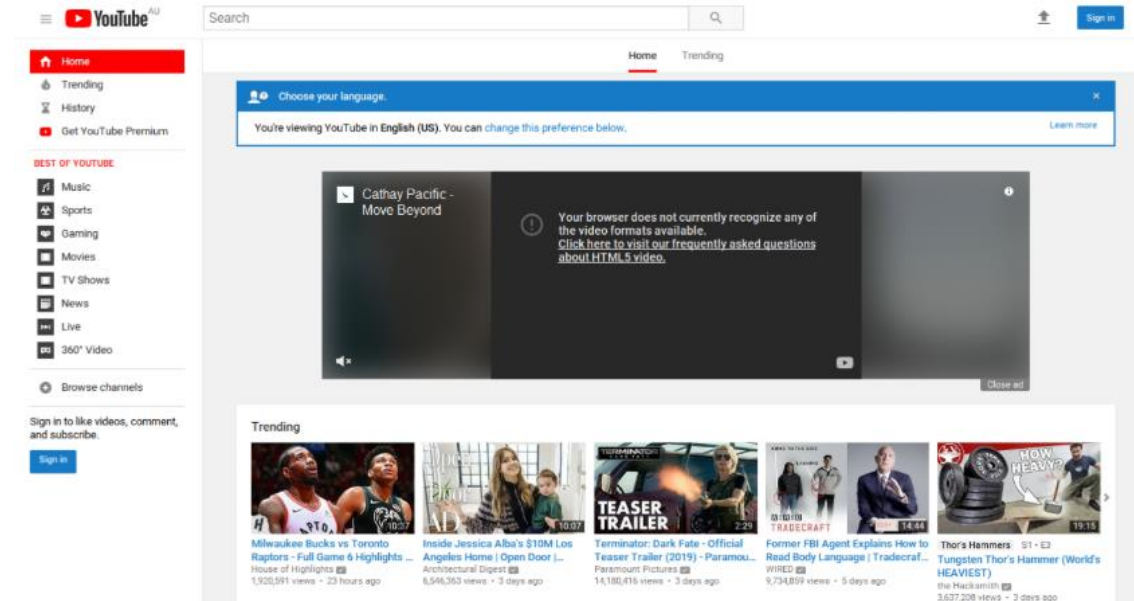
User Scenario 2



This is what I want !!!
It would be perfect if I
can have the similar
design style !!!

Bob – Web Developer

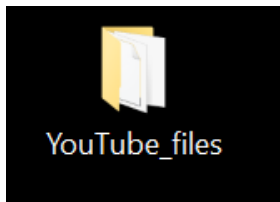
Care about nothing except coding



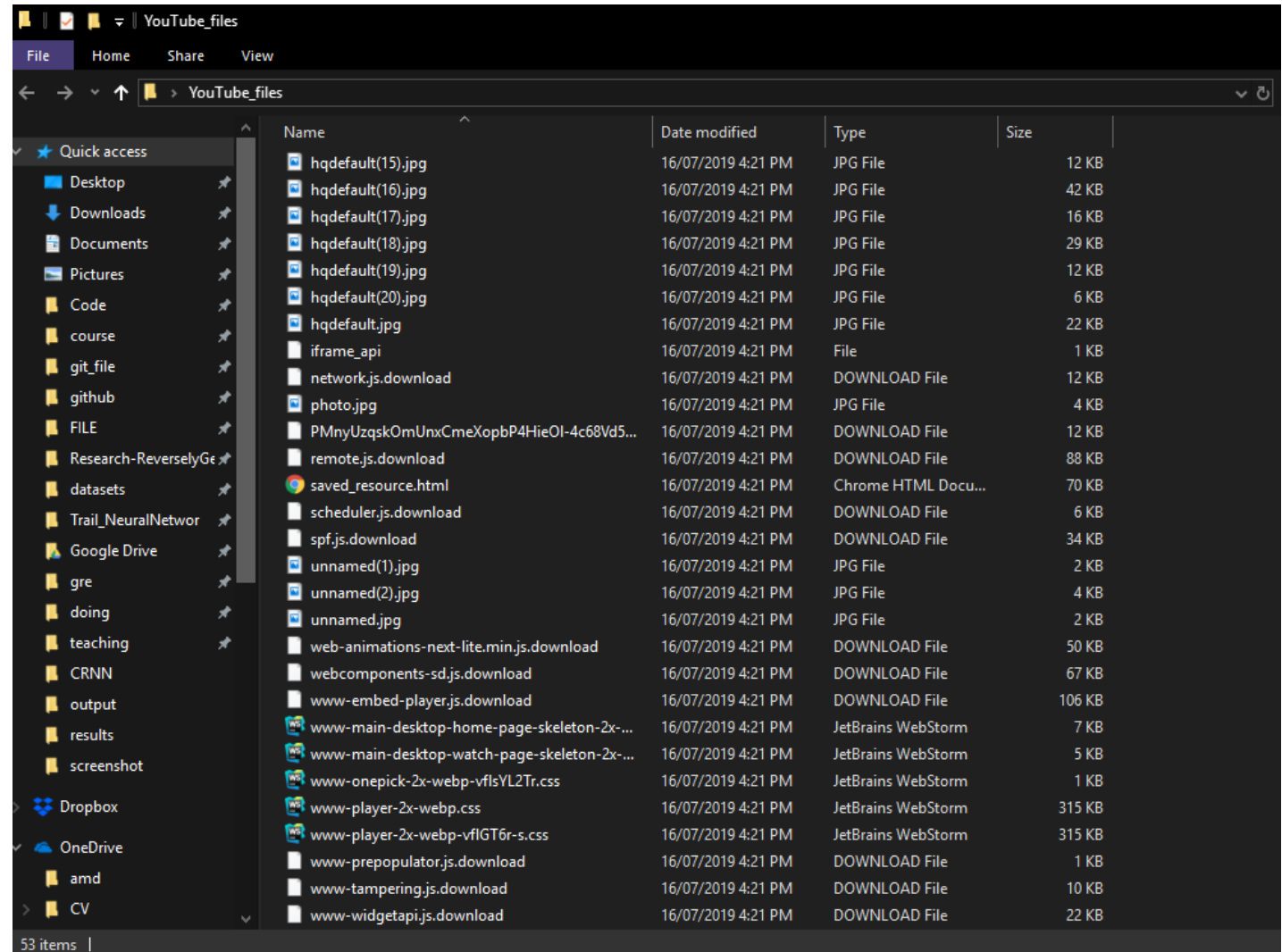
WHAT IS THIS?

User Scenario 2

Conventional Way to Reuse UI



Download the Source Code



WHAT IS THIS?

User Scenario 2: Screenshot to Code – UI Reuse



Input: Screenshot of Web page



IMG2CODE



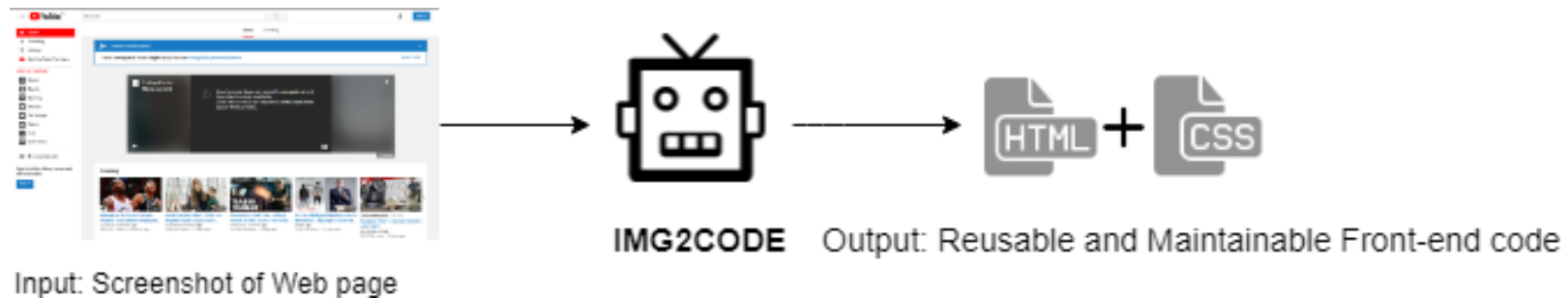
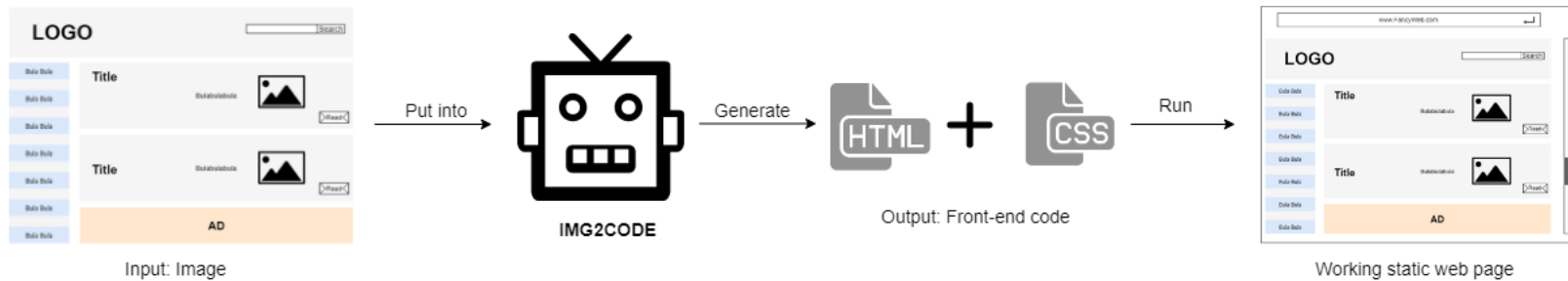
Output: Reusable and Maintainable Front-end code

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Title</title>
  <link rel="stylesheet" href="a.css" type="text/css">
</head>
<body>
<div class="generated_container">
  <div id="div0"></div>
  <div id="div1">
    <input id="input1">
    <input id="input2">
  </div>
  <div id="div2">
    <button id="button1">Button</button>
    <button id="button2">Button</button>
  </div>
  <div id="div3">
    <h1 id="h1">Text in H1</h1>
    <h2 id="h2">Text in H2</h2>
    <p id="p1">Text in p</p>
    <p id="p2">Text in p2</p>
  </div>
  <div id="div4"></div>
  <div id="div5"></div>
  <div id="img6"></div>
  <div id="img7"></div>
  <div id="img8"></div>
  <div id="img9"></div>
  <div id="img10"></div>
  <div id="img11"></div>
  <div id="img12"></div>
  <div id="img13"></div>
  <div id="img14"></div>
  <div id="img15"></div>
  <div id="img16"></div>
</div>
</body>
</html>
```

PROBLEM STATEMENT

Final Goal

Generate the front-end CODE from any given web page IMAGE



PROBLEM STATEMENT

Final Goal

Generate the front-end
CODE from any given web
page IMAGE



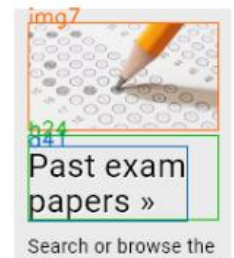
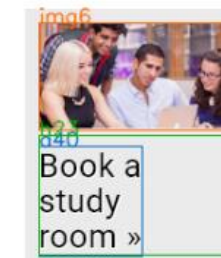
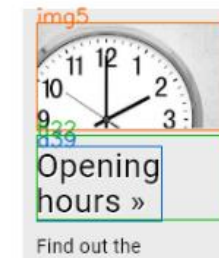
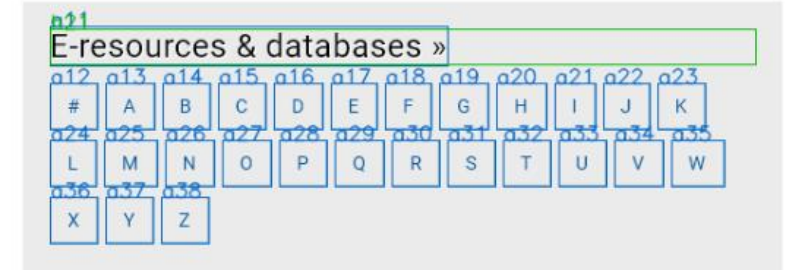
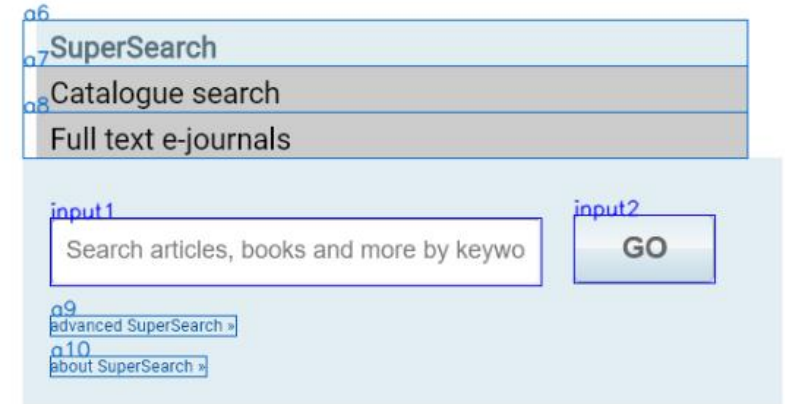
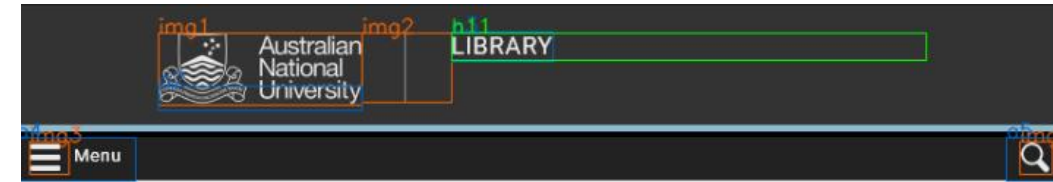
Sub Goals

1. Detect and classify UI components (Button, Text, Image) on the input image
2. Reversely generate usable front-end code (HTML, CSS)

PROBLEM STATEMENT

UI Components Detection and Classification

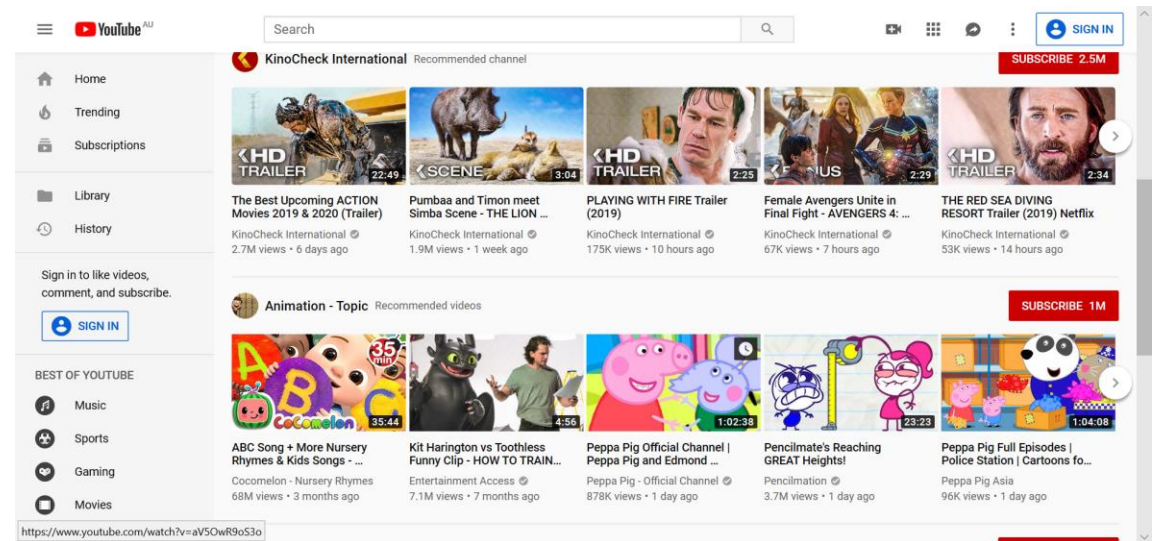
Tricky problem: Efficient detection of simple UI components



PROBLEM STATEMENT

UI Components Detection and Classification

Tricky problem: Misrecognize contents of the `` as the web components.



PROBLEM STATEMENT

Maintainable Code Generating

Tricky problem: Make generated code easy to edit and extend.

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Title</title>
  <link rel="stylesheet" href="a.css" type="text/css">
</head>
<body>
<div class="generated_container">
  <div id="div0"></div>
  <div id="div1">
    <input id="input1">
    <input id="input2">
  </div>
  <div id="div2">
    <button id="button1">Button</button>
    <button id="button2">Button</button>
  </div>
  <div id="div3">
    <h1 id="h11">Text in H1</h1>
    <h2 id="h21">Text in H2</h2>
    <p id="p1">Text in p</p>
    <p id="p2">Text in p2</p>
  </div>
  <div id="div4"></div>
  <div id="div5"></div>
  <div id="img6"></div>
  <div id="img7"></div>
  <div id="img8"></div>
  <div id="img9"></div>
  <div id="img10"></div>
  <div id="img11"></div>
  <div id="img12"></div>
  <div id="img13"></div>
  <div id="img14"></div>
  <div id="img15"></div>
  <div id="img16"></div>
</div>
</body>
</html>
```

```
#div0{
  width: 650px; height: 30px;
  margin-top: 10px; margin-left: 229px;
  position: absolute;
  border: grey solid 1px;
}
#div1{
  width: 56px; height: 29px;
  margin-top: 10px; margin-left: 1279px;
  position: absolute;
  border: grey solid 1px;
}
#div2{
  width: 186px; height: 28px;
  margin-top: 63px; margin-left: 21px;
  position: absolute;
  border: grey solid 1px;
}
#div3{
  width: 1056px; height: 79px;
  margin-top: 100px; margin-left: 269px;
  position: absolute;
  border: grey solid 1px;
}
#div4{
  width: 1060px; height: 511px;
  margin-top: 488px; margin-left: 267px;
  position: absolute;
  border: grey solid 1px;
}
#div5{
  width: 56px; height: 29px;
  margin-top: 544px; margin-left: 21px;
  position: absolute;
  border: grey solid 1px;
}
#img6{
  width: 850px; height: 264px;
  margin-top: 209px; margin-left: 372px;
  position: absolute;
  background: black;
}
```

PROGRESS

Attempts on UI Components Detection and Classification

1. End-to-End: Deep Learning

Object detection method

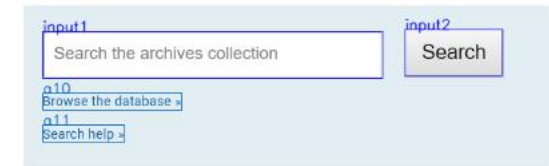
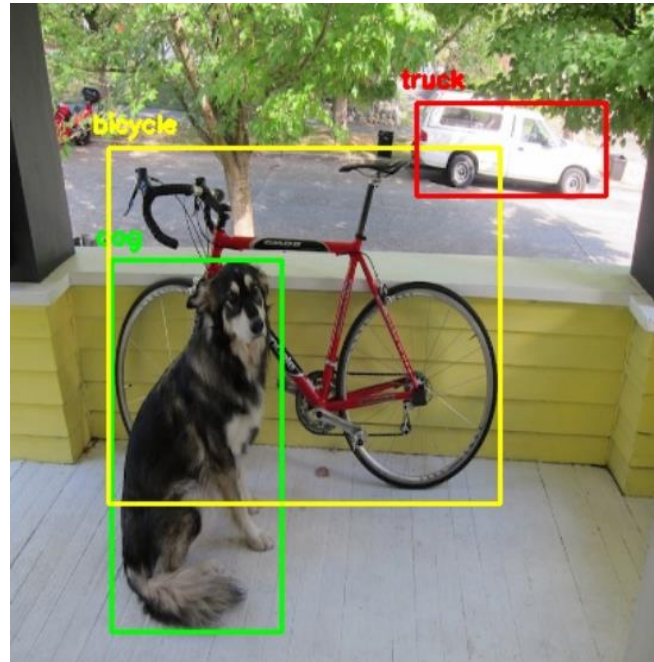
2. Divide and Conquer: Image Processing + Machine Learning

Decompose elements and Classify them

PROGRESS

End-to-End
(Deep Learning)

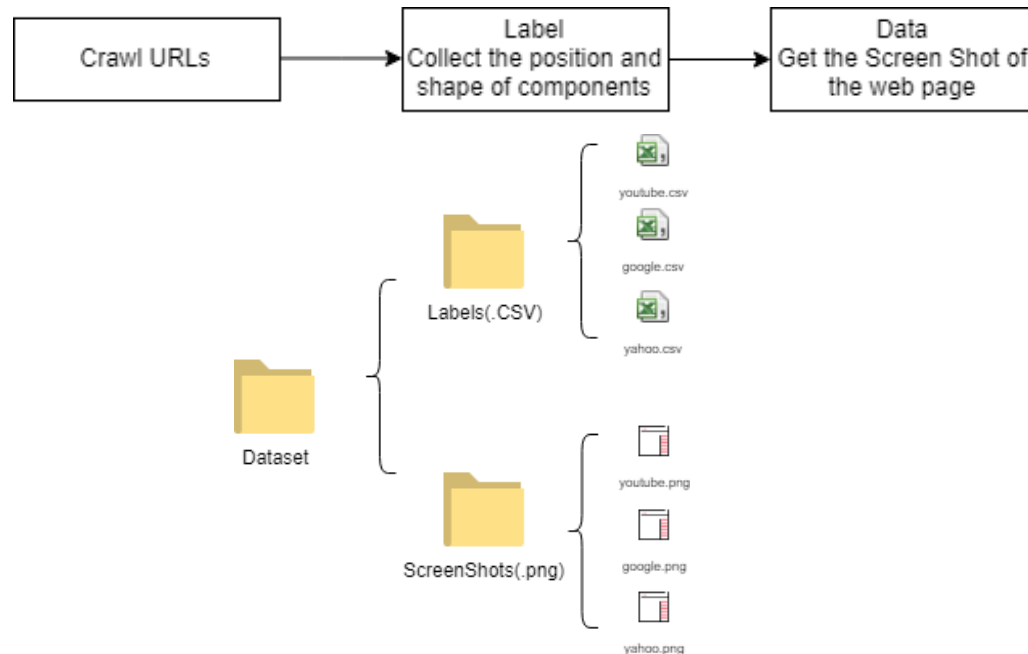
Refer to the Object
Detection Method



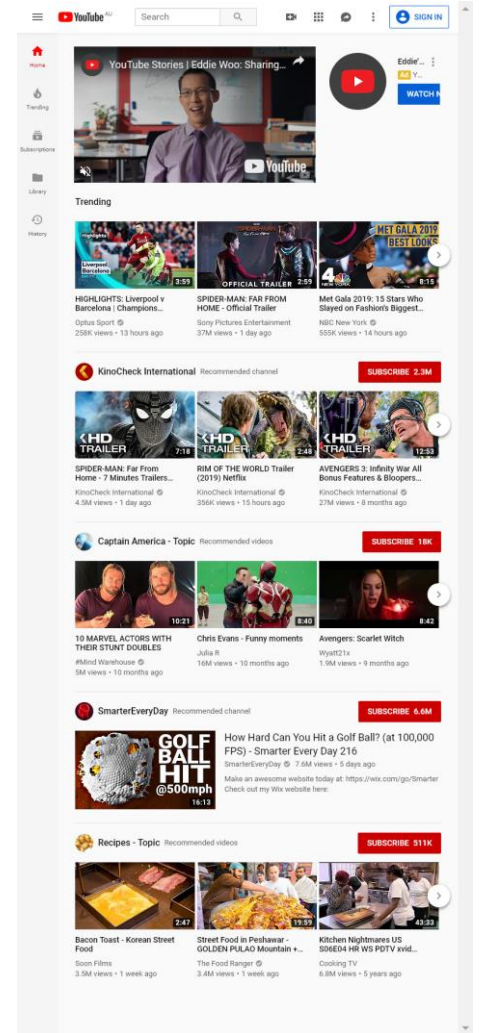
PROGRESS

End-to-End (Deep Learning)

Dataset Collection



A	B	C	D	E	F
	bx	by	bw	bh	element
0	179	200	80	80	img
1	637	142	16	16	img
2	704	142	16	16	img
3	732	142	16	16	img
4	102	737	210	118	img
5	316	737	210	118	img
6	530	737	210	118	img
7	744	737	210	118	img
8	958	737	210	118	img
9	1172	737	210	118	img
10	102	1051	210	118	img
11	316	1051	210	118	img
12	530	1051	210	118	img
13	744	1051	210	118	img
14	958	1051	210	118	img
15	1172	1051	210	118	img
16	102	1415	210	118	img
17	316	1415	210	118	img
18	530	1415	210	118	img
19	744	1415	210	118	img
20	958	1415	210	118	img
21	1172	1415	210	118	img
22	102	1729	210	118	img
23	316	1729	210	118	img
24	72	16	80	24	a
25	16	-1000	148	37	a
26	461	8	40	40	a
27	509	8	40	40	a
28	557	8	40	40	a

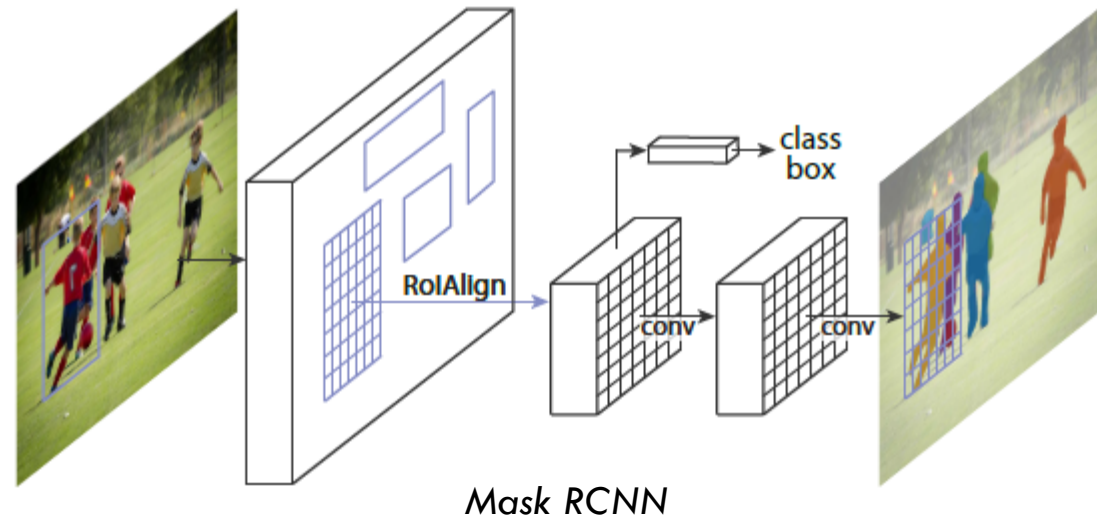
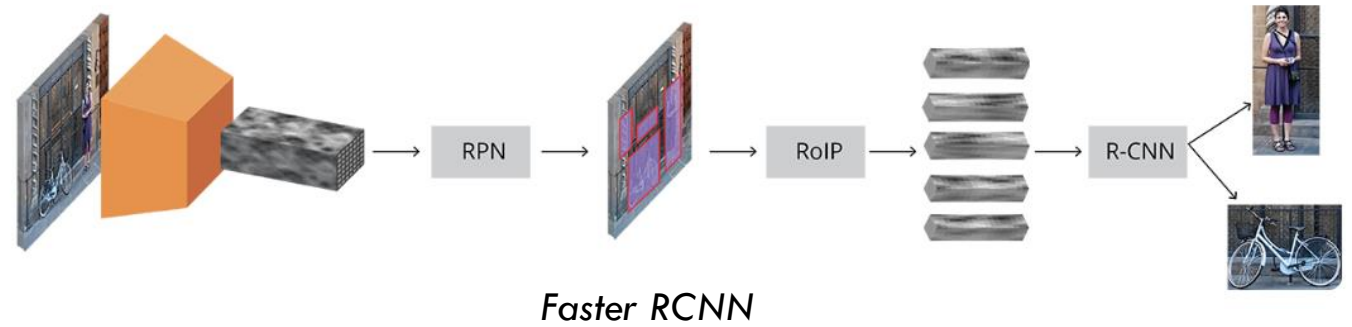


PROGRESS

End-to-End (Deep Learning)

Model Selection

1. YOLO v3
2. Faster RCNN
3. Mask RCNN

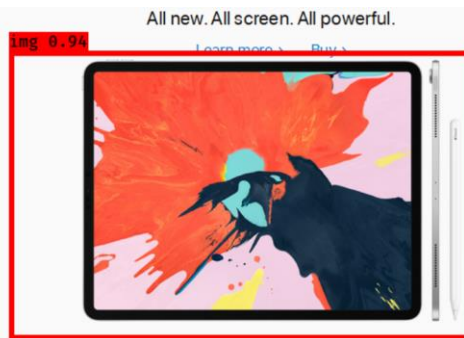


PROGRESS

End-to-End (Deep Learning)

Experiment:

YOLOv3 + VGG16 (Base Net)



From today's featured list

The **Chief Minister of Karnataka** is the chief executive of the Indian state of Karnataka. As per the Constitution of India, the governor is a state's *de jure* head, but *de facto* executive authority rests with the chief minister. Following elections to the Karnataka Legislative Assembly, the state's governor usually invites the party (or coalition) with a majority of seats to form the **government**. The governor appoints the chief minister, whose **council of ministers** are collectively responsible to the assembly. Since 1947, twenty-two people have been Chief Minister of Mysore (as the state was known before 1 November 1973) and Karnataka. A majority of them belonged to the **Indian National Congress** party, including inaugural office-holder **K. Chengalaraya Reddy**. The incumbent chief minister is the Janata Dai (Secular)'s **H. D. Kumaraswamy** (*pictured*), who was sworn in on 23 May 2018. ([Full list...](#))

Recently featured: [Game of Thrones episodes](#) · [Awards and nominations received by Alessia Cara](#) · [National monuments of the United States](#)
[Archive](#) · [More featured lists](#)

Today's featured picture

George Washington Carver (1860s–1943) was an American agricultural scientist and inventor. Born into slavery in Diamond, Missouri, he was raised by his master **Moses Carver** after being emancipated, having been separated from his parents as an infant during a kidnapping incident. After college, Carver became a professor at **Tuskegee Institute**, where he developed techniques to improve soils depleted by repeated plantings of cotton. He wanted poor farmers to grow alternative crops, such as peanuts and sweet potatoes, as a source of their own food and to improve their quality of life. Carver spent years developing and promoting products made from peanuts, although none became commercially successful. Apart from his work to improve the lives of farmers, he was also a leader in promoting **environmentalism**. Carver received numerous honors for his work, including the **NAACP's Spingarn Medal**. In an era of very high racial polarization, his fame reached beyond the black community; he was widely recognized and praised in the white community for his many achievements and talents. In 1941, *Time* magazine dubbed Carver a "black Leonardo".

This picture of Carver was taken around 1910 and is in the collection of the Tuskegee University archives.

Photograph credit: Unknown; restored by Adam Cuerden

Indie Music - Topic Recommendations

Back To The 80's | Best of Synthwave And Retro Electro...
ThePrimeThanatos
14,784,370 views · 2 years ago

Relaxing Sunday Mornings - An Indie/Folk/Pop Playlist | Vol. 1
alexrainbirdMusic
10,522,191 views · 2 years ago

Bastille - Oblivion (Official Music Video)
BASTILLEVideos
16,689,427 views · 4 years ago

Lovely - Billie Eilish & Khalid | Cover | Nikki Lilly
Nikki Lilly
9,695,835 views · 3 months ago

Imagine Dragons - Not Today from ME BEFORE YOU
Jhonaz
60,903,233 views · 2 years ago

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SurajFineArts - Abstract ART
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Emergency Awesome
763,199 views · 4 days ago

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FORMULA 1
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Unbox Therapy
1,987,002 views · 4 days ago

SPIDER-MAN FAR FROM HOME Trailer #3 NEW (2019) Marvel...
MovieAccessTrailers
2,200,502 views · 2 days ago

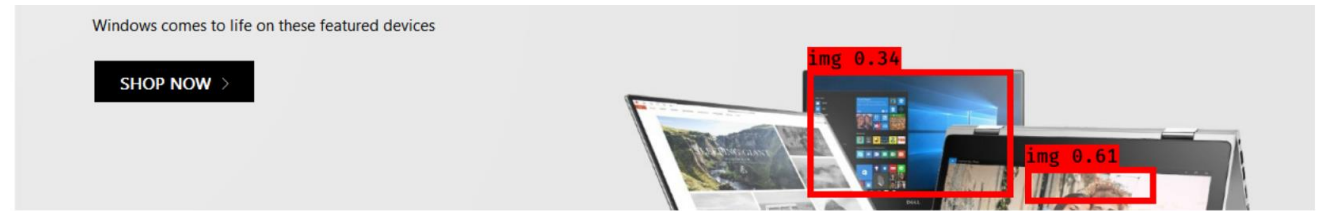
PROGRESS

End-to-End (Deep Learning)

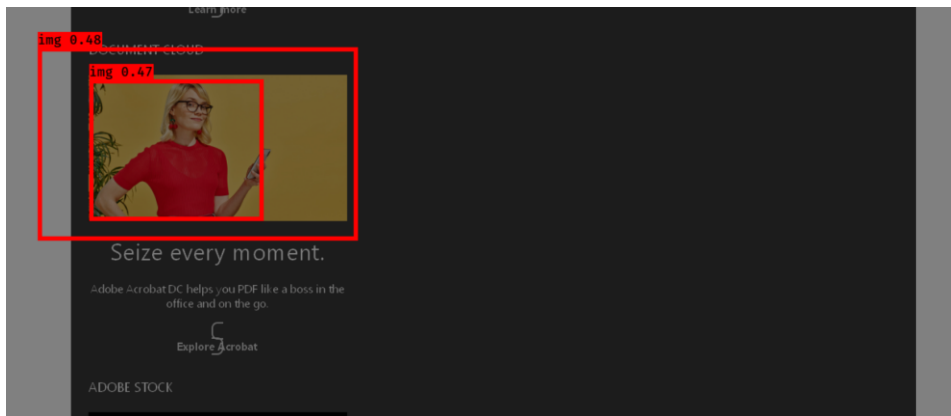
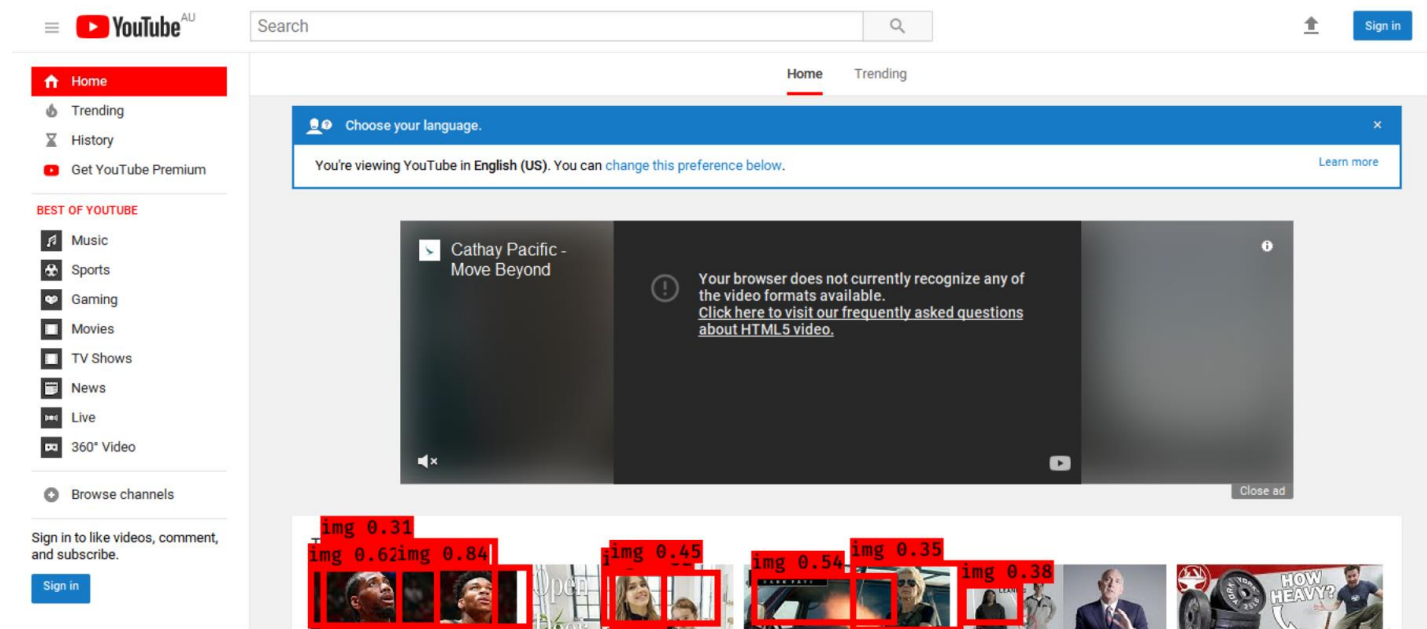
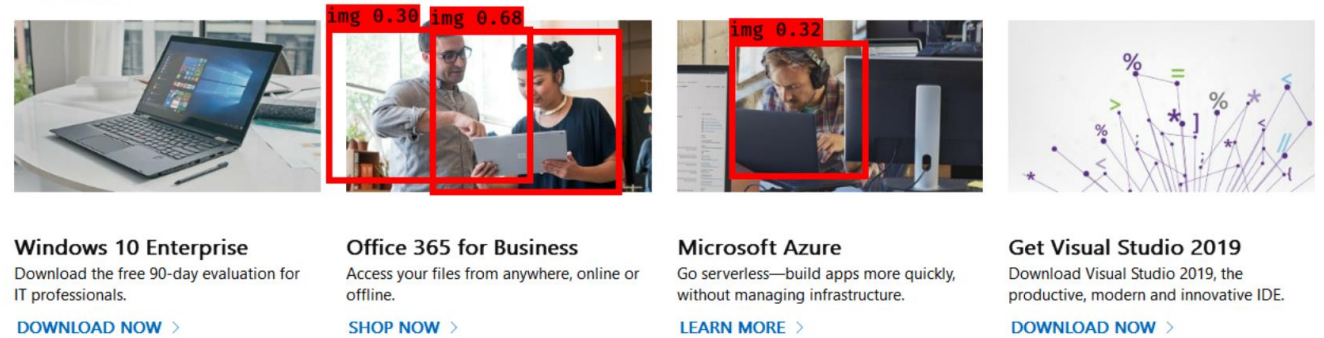
Experiment:

YOLOv3 + VGG16 (Base Net)

Trained on 1200 Images



For work

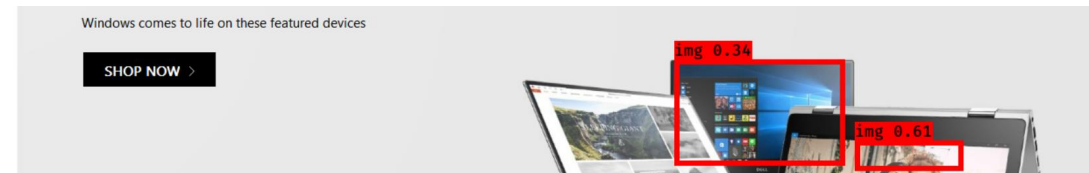
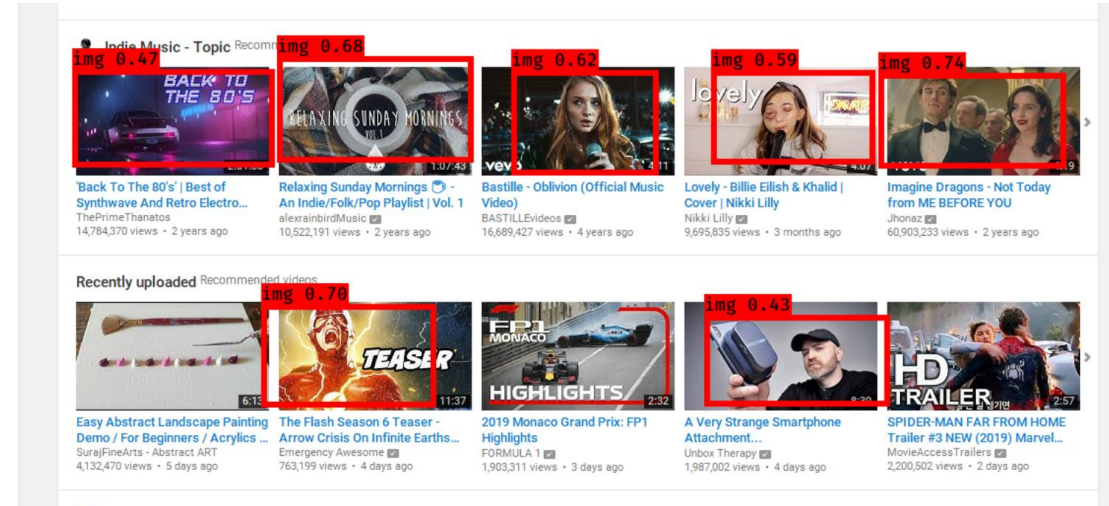


PROGRESS

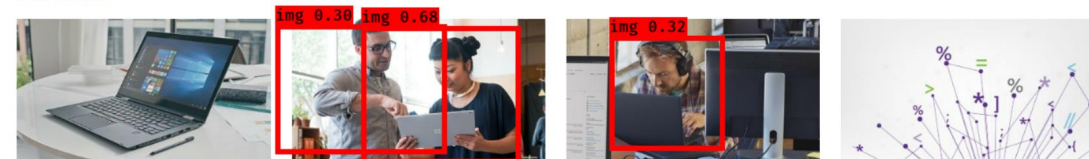
End-to-End (Deep Learning)

Issues:

1. Hard to predict the accurate position of elements
2. Susceptible to the complex image elements on the screenshot



For work



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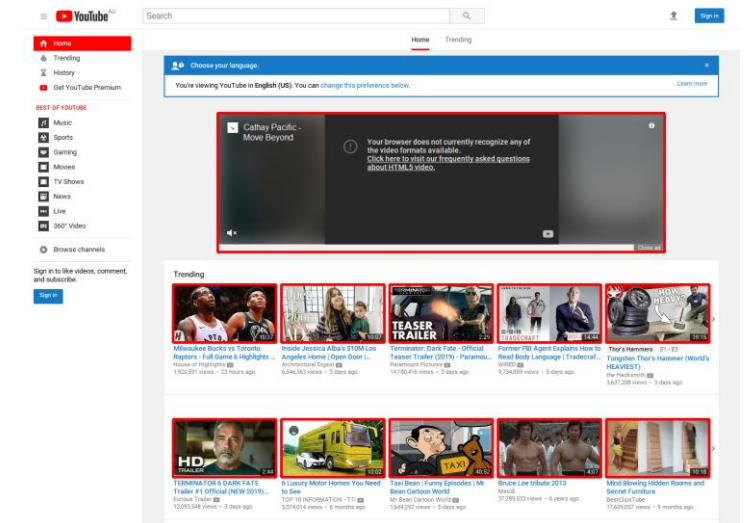
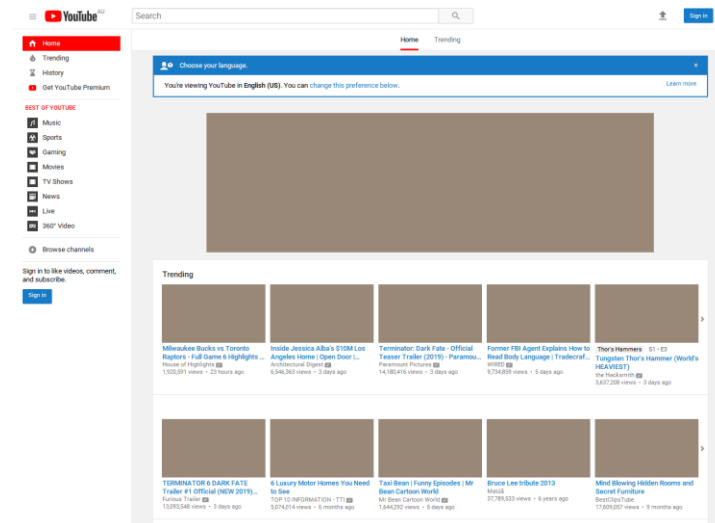
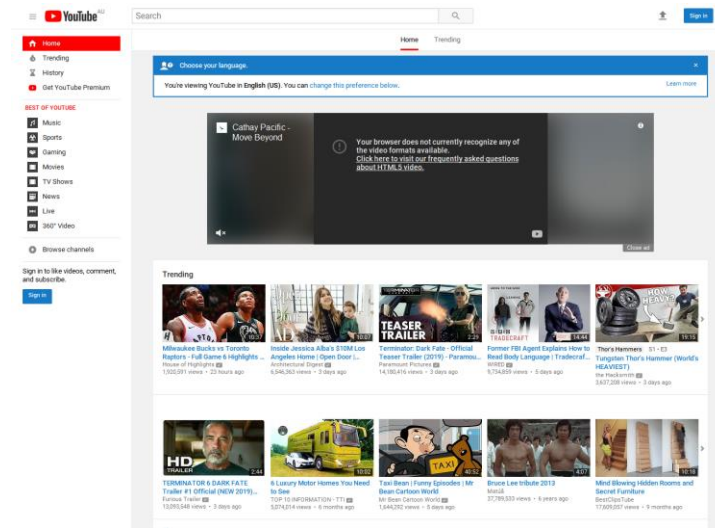
[DOWNLOAD NOW >](#)

PROGRESS

Divide and Conquer (Computer Vision)

Process:

1. Detect and Separate the `<image>` components on the screenshot first
2. Classify the other UI components

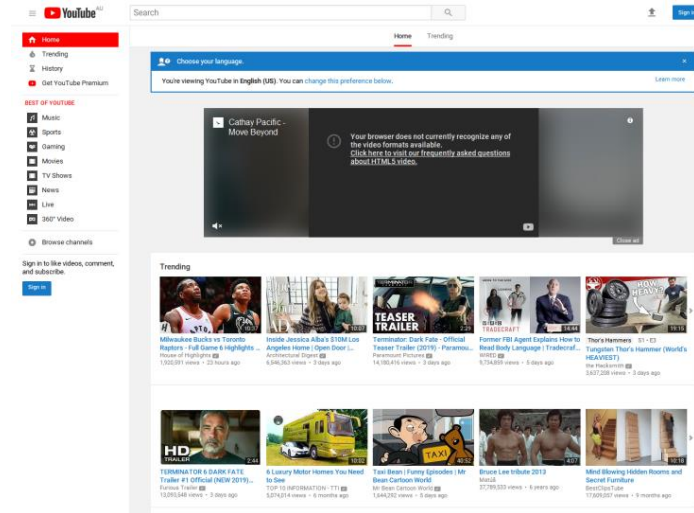
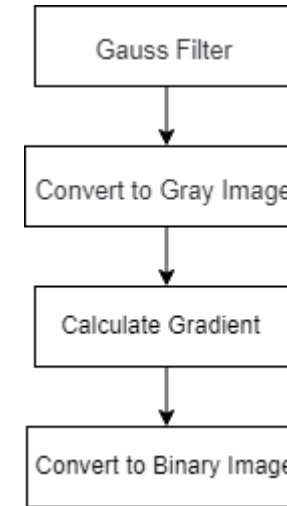


PROGRESS

Divide and Conquer (Computer Vision)

 Detection:

Original Image Processing
Algorithms



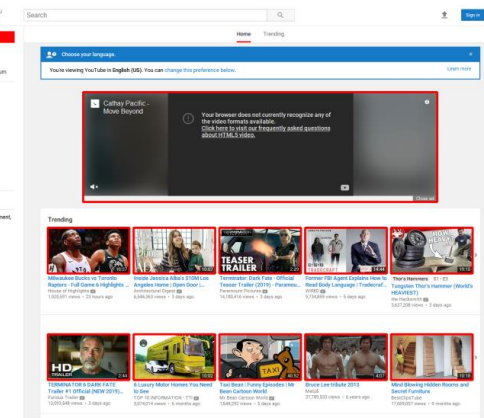
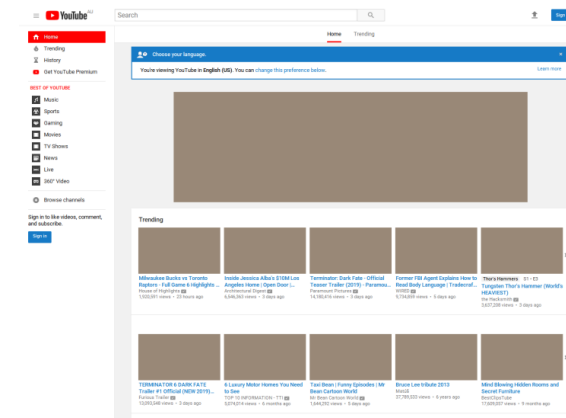
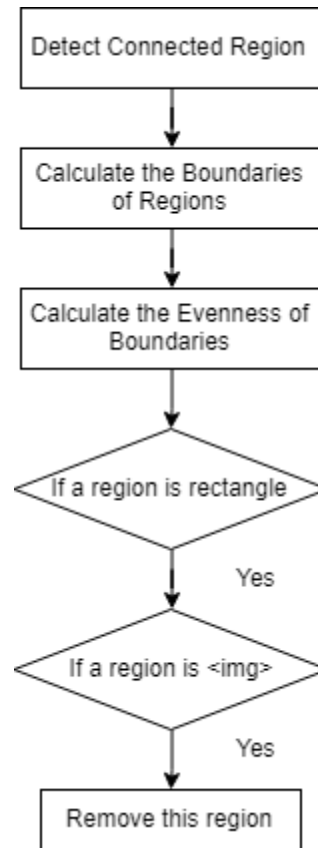
Pre-processing

PROGRESS

Divide and Conquer (Computer Vision)

 Detection:

Original Image Processing
Algorithms



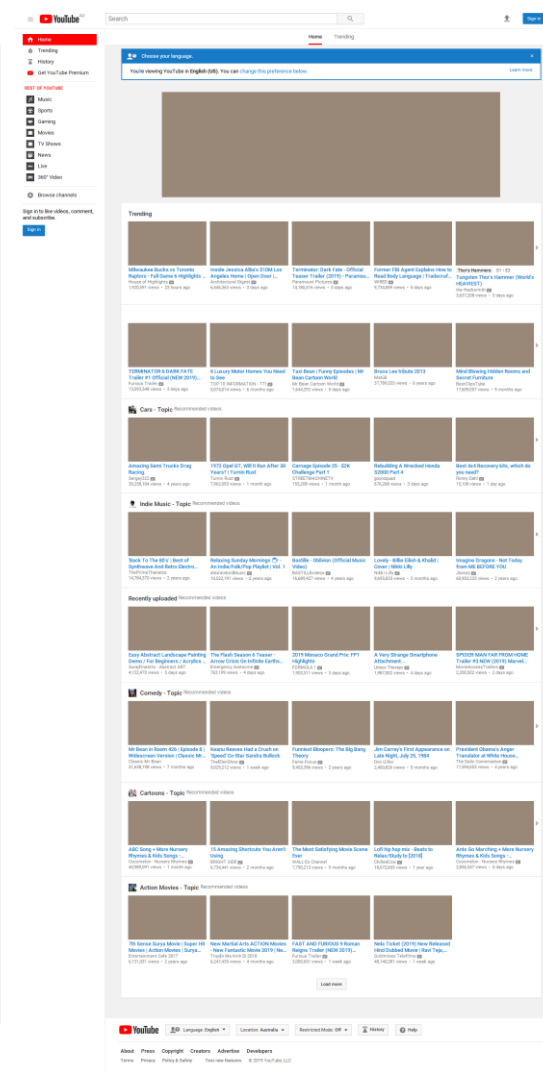
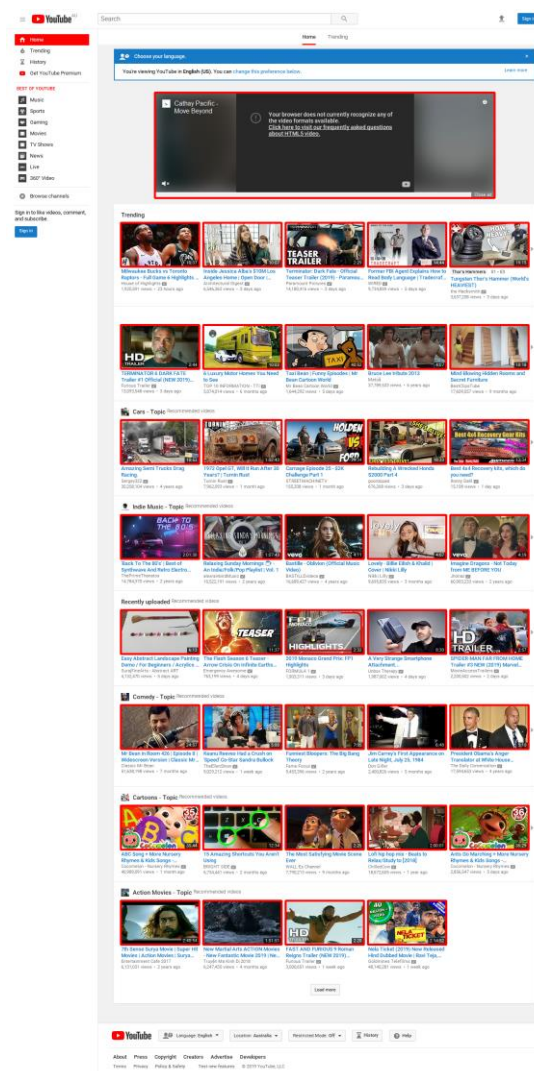
Region processing

PROGRESS

Divide and Conquer (Computer Vision)

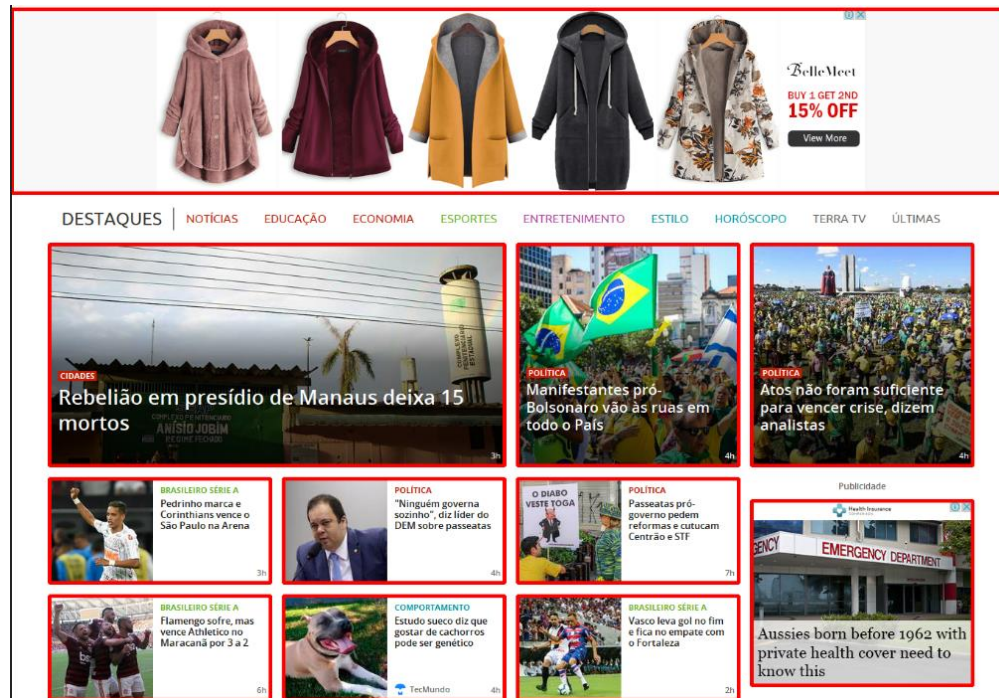
 Detection:

Original Image Processing
Algorithms

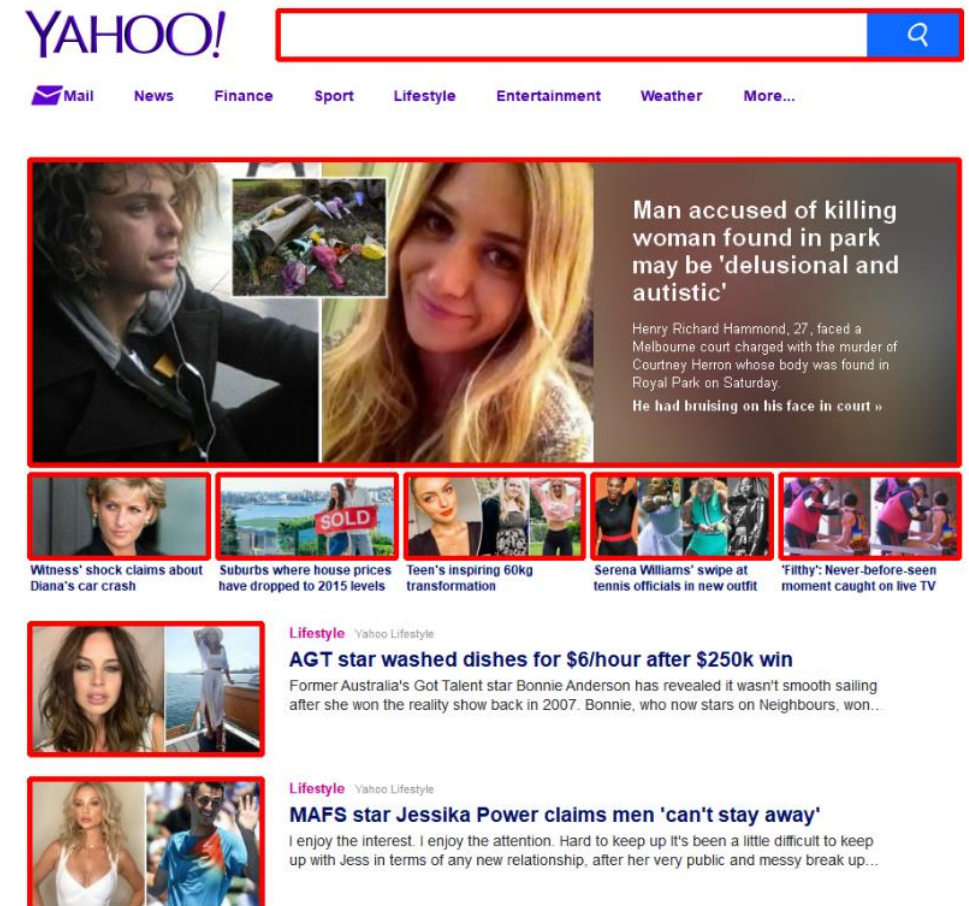


RESULTS

Image Detection



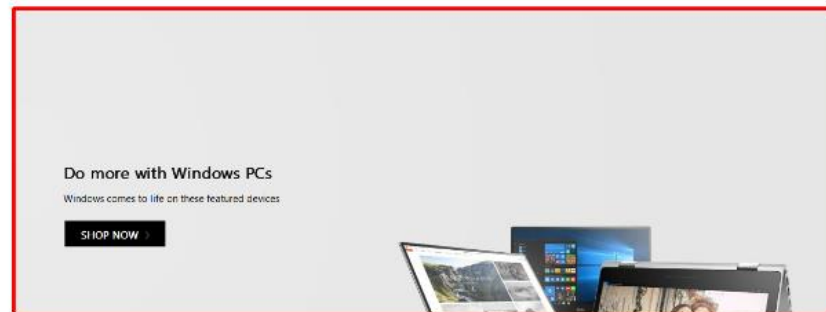
The screenshot shows a Brazilian e-commerce website. At the top, there is a promotion for coats: "ZelleMeet BUY 1 GET 2ND 15% OFF View More". Below this is a navigation bar with categories: DESTAQUES, NOTÍCIAS, EDUCAÇÃO, ECONOMIA, ESPORTES, ENTRETENIMENTO, ESTILO, HORÓSCOPO, TERRA TV, and ÚLTIMAS. The main content area features a grid of news articles. The first article is titled "Rebelião em presídio de Manaus deixa 15 mortos" (Rebellion in Manaus prison leaves 15 dead). Other articles include "Manifestantes pró-Bolsonaro vão às ruas em todo o País" (Pro-Bolsonaro protesters go to the streets in all of Brazil), "Atos não foram suficiente para vencer crise, dizem analistas" (Acts were not enough to win the crisis, say analysts), "Passeatas pró-governo pedem reformas e cutucam Centrão e STF" (Pro-government rallies demand reforms and poke at the Centrão and STF), "Ninguém governa sozinho", "Flamengo sofre, mas vence Atlético no Maracanã por 3 a 2", "Estudo sueco diz que gostar de cachorros pode ser genético", "Vasco leva gol no fim e fica no empate com o Fortaleza", and "Aussies born before 1962 with private health cover need to know this".



The screenshot shows the Yahoo! homepage. At the top is the Yahoo! logo and a search bar. Below the search bar is a navigation bar with links: Mail, News, Finance, Sport, Lifestyle, Entertainment, Weather, and More... The main content area features a grid of news articles. The first article is titled "Man accused of killing woman found in park may be 'delusional and autistic'" (Man accused of killing woman found in park may be 'delusional and autistic'). Other articles include "Witness' shock claims about Diana's car crash", "Suburbs where house prices have dropped to 2015 levels", "Teen's inspiring 60kg transformation", "Serena Williams' swipe at tennis officials in new outfit", "Filthy: Never-before-seen moment caught on live TV", "AGT star washed dishes for \$6/hour after \$250k win", "MAFS star Jessika Power claims men 'can't stay away'", and "Aussies born before 1962 with private health cover need to know this".

RESULTS

Image Detection



For work



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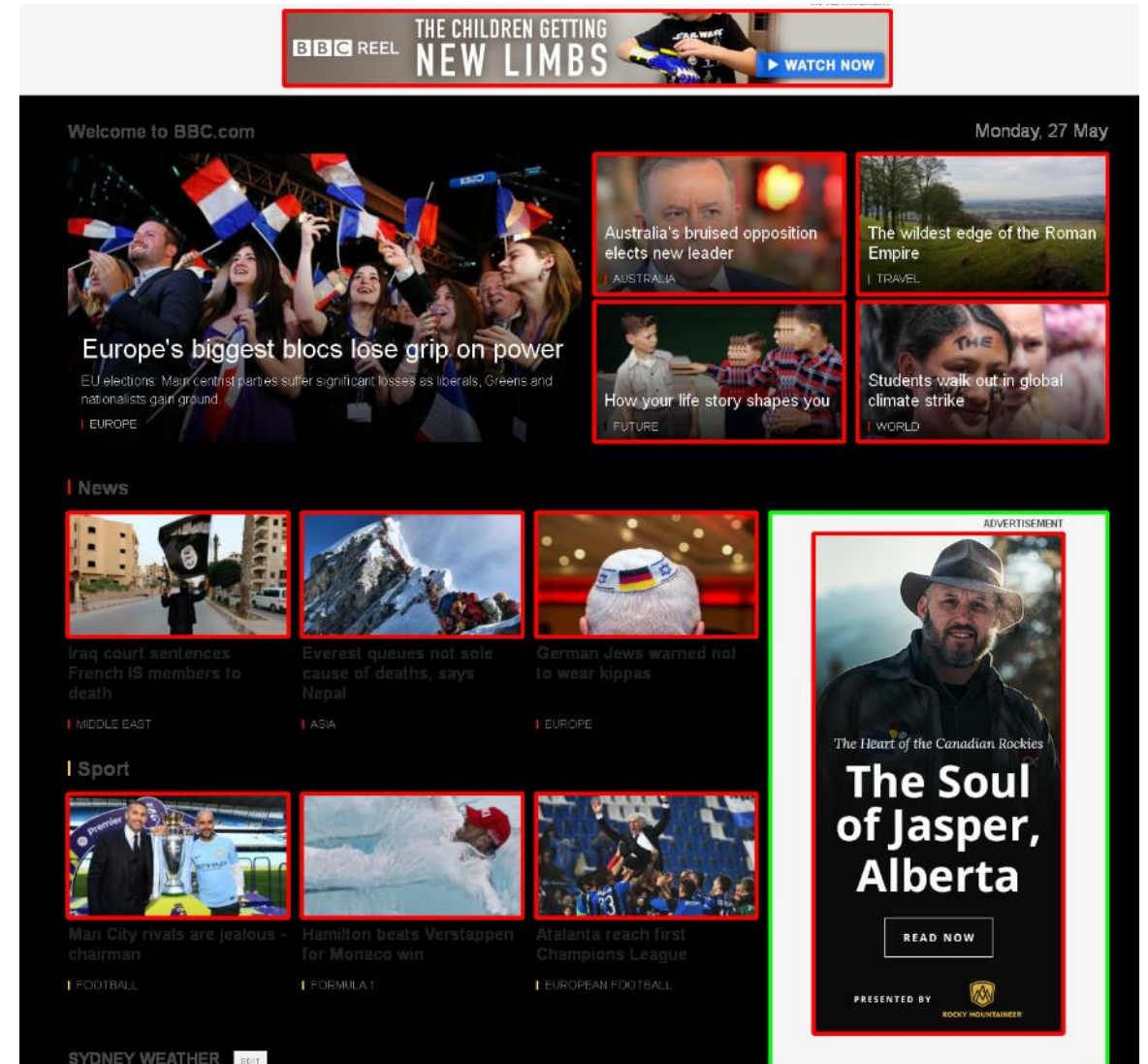
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RESULTS


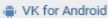
Image Detection



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Wiki Loves Earth photo contest: Upload photos of Australia's natural heritage sites to help Wikipedia and win prizes!

Welcome to Wikipedia,

the free encyclopedia that anyone can edit.
5,961,863 articles in English

From today's featured article



Arthur Mold (27 May 1863 – 29 April 1921) was an English professional cricketer. He began his cricket career playing for **Danbury** and **Northamptonshire** in the mid-1880s, then played first-class cricket for Lancashire as a fast bowler between 1889 and 1901. A **Wisden Cricketer of the Year** in 1892, he was selected for England in three Test matches in 1893. Mold was one of the most effective bowlers in England during the 1890s but his career was overshadowed by controversy over his bowling action; many critics thought he **threw** rather than bowled the ball. He was penalised in 1900 and 1901 by the umpire **Jin Phillips**, who had targeted several prominent bowlers with dubious bowling actions. Although Mold took 1,673 wickets in first-class matches, many commentators viewed his achievements as tainted. After his departure from the game, throwing ceased to be a concern in English cricket for 50 years. [\(Full article...\)](#)

Recently featured: [History of Aston Villa F.C. \(1961–present\)](#) · [Crawford expedition](#) · [Ashton-under-Lyne](#)

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Did you know...

- ... that the traditional north German card game of **Fipsen** is played in the village of Thedinghausen for currant buns called *Hedewigs* *(example pictured?)*
- ... that while chief engineer of the Municipal Corporation of Delhi, **Ramesh Sumant Mehta** implemented what was at the time the largest municipal drainage system in India?
- ... that during construction of the tower for Oklahoma City's **KLPR-TV** station, a worker was trapped 200 ft (61 m) in the air for more than an hour?
- ... that before she became an expert on wild animals, **Hope Ryden** was an international flight attendant and used her long layovers to observe wildlife in Africa and Asia?
- ... that **Nepal's first officially recorded tornado** occurred in March 2019?
- ... that **James Wilson Robertson** resigned as the first principal of Macdonald College after his spending was restricted to \$100?
- ... that during the Soviet period the **Feodorovskaya Church** was a factory dormitory, the **Gate Church** was museum office space, and the **Dukhovskaya Church** became a boiler room?
- ... that **Kaylee Davidson-Oiley** survived an infant heart transplant to win gold in a 4 × 100 metres relay?

· [Start a new article](#) · [Nominate an article](#)

In the news

- British Prime Minister **Theresa May** *(pictured)*, under pressure over her handling of **Brexit**, announces her intention to resign.
- A **prison riot** in Acarigua, Venezuela, leaves 29 prisoners dead and 19 guards injured.
- A **fire** at a commercial complex in Surat, India, kills 22 students in a coaching centre.
- The incumbent Bharatiya Janata Party and its allies, led by Narendra Modi, win a majority in the **Indian general election**.
- Joko Widodo is **re-elected** President of Indonesia, and his party, PDI-P, wins the largest share of legislative votes.

Recent deaths

- Murray Gell-Mann · Beaton Tulk · Judith Kerr · Binyavanga Wainaina · Nan Winton

[Other recent events](#) · [Nominate an article](#)

On this day

May 27: Memorial Day in the United States (2019)

- 1096 – The largest of the **Rhineland massacres** took place in Mainz, where at least 1,100 Jews were killed by the People's Crusade.
- 1644 – Manchu regent Dorgon *(pictured)* defeated rebel leader Li Zicheng of the Shun dynasty at the **Battle of Shanhai Pass**, allowing the Manchus to enter and conquer the capital city of Beijing.
- 1923 – French drivers André Lagache and René Léonard won the **first running** of the 24 Hours of Le Mans sports car race.
- 1971 – The deadliest road accident in England took place when a coach talled and it **crashed** in North Yorkshire, killing 32 people.
- 1995 – American actor **Christopher Reeve** was thrown from his horse, leaving him a quadriplegic; he later became an activist on behalf of people with spinal cord injuries.

Antoine Daniel (d. 1601) · Julia Ward Howe (b. 1819) · Gérard Jean-Juste (d. 2009)

More anniversaries: [May 26](#) · [May 27](#) · [May 28](#)

· [By email](#) · [List of historical anniversaries](#)

RESULTS

Code Generation

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Title</title>
  <link rel="stylesheet" href="a.css" type="text/css">
</head>
<body>
<div class="generated_container">
  <div id="div0"></div>
  <div id="div1">
    <input id="input1">
    <input id="input2">
  </div>
  <div id="div2">
    <button id="button1">Button</button>
    <button id="button2">Button</button>
  </div>
  <div id="div3">
    <h1 id="h11">Text in H1</h1>
    <h2 id="h21">Text in H2</h2>
    <p id="p1">Text in p</p>
    <p id="p2">Text in p2</p>
  </div>
  <div id="div4"></div>
  <div id="div5"></div>
  <div id="img6"></div>
  <div id="img7"></div>
  <div id="img8"></div>
  <div id="img9"></div>
  <div id="img10"></div>
  <div id="img11"></div>
  <div id="img12"></div>
  <div id="img13"></div>
  <div id="img14"></div>
  <div id="img15"></div>
  <div id="img16"></div>
</div>
</body>
</html>
```

```
#div0{
  width: 650px; height: 30px;
  margin-top: 10px; margin-left: 229px;
  position: absolute;
  border: grey solid 1px;
}
#div1{
  width: 56px; height: 29px;
  margin-top: 10px; margin-left: 1279px;
  position: absolute;
  border: grey solid 1px;
}
#div2{
  width: 186px; height: 28px;
  margin-top: 63px; margin-left: 21px;
  position: absolute;
  border: grey solid 1px;
}
#div3{
  width: 1056px; height: 79px;
  margin-top: 100px; margin-left: 269px;
  position: absolute;
  border: grey solid 1px;
}
#div4{
  width: 1060px; height: 511px;
  margin-top: 488px; margin-left: 267px;
  position: absolute;
  border: grey solid 1px;
}
#div5{
  width: 56px; height: 29px;
  margin-top: 544px; margin-left: 21px;
  position: absolute;
  border: grey solid 1px;
}
#img6{
  width: 850px; height: 264px;
  margin-top: 209px; margin-left: 372px;
  position: absolute;
  background: black;
}
```


FUTURE WORK

Image Processing

1. Simple UI components detection and classification (Object Detection)
2. Text detection (OCR)

Code Generation

1. Extendable and maintainable code
2. Fit to real developer's usual practice