Facial Recognition

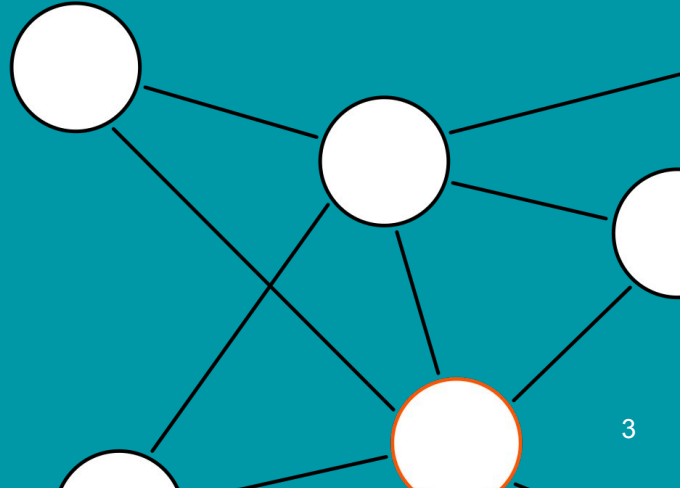Spencer Rhoden & Jacob Sampley

Research Goal

Understand the processes, software, and hardware needed to implement facial recognition, as well as the potential benefits and challenges it poses to society
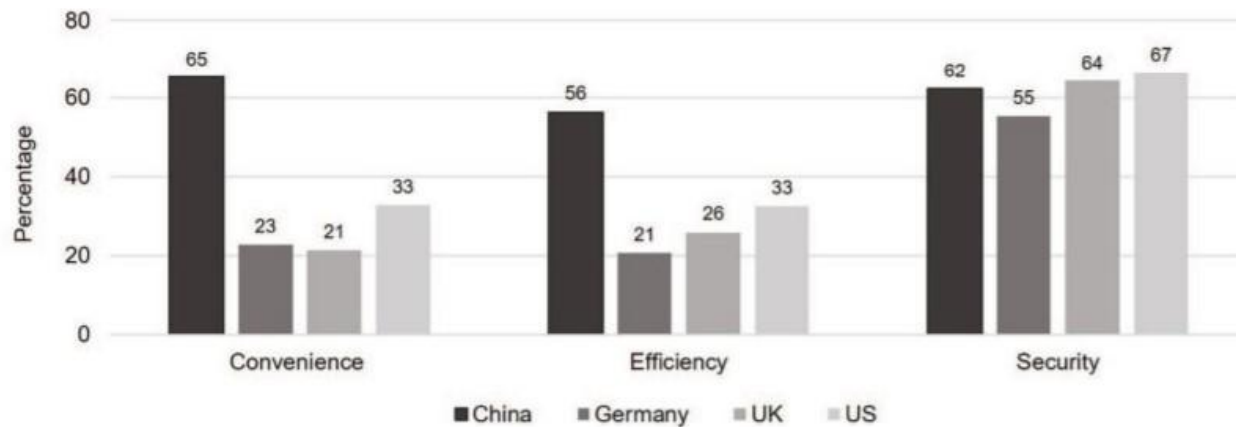
What we found

- Facial Recognition is difficult to implement

- Privacy Issues

- Acceptance

- Prevalence

Perceived Benefits

	Convenience	Efficiency	Security
China	65	56	62
Germany	23	21	55
UK	21	26	64
US	33	33	67

Perceived Risks

	Privacy Violation	Discrimination	Surveillance
China	31	3	27
Germany	49	15	63
UK	41	17	57
US	45	17	56

SMILE, YOU'RE ON CAMERA
THE FACIAL RECOGNITION WORLD MAP

Legend:
- IN USE
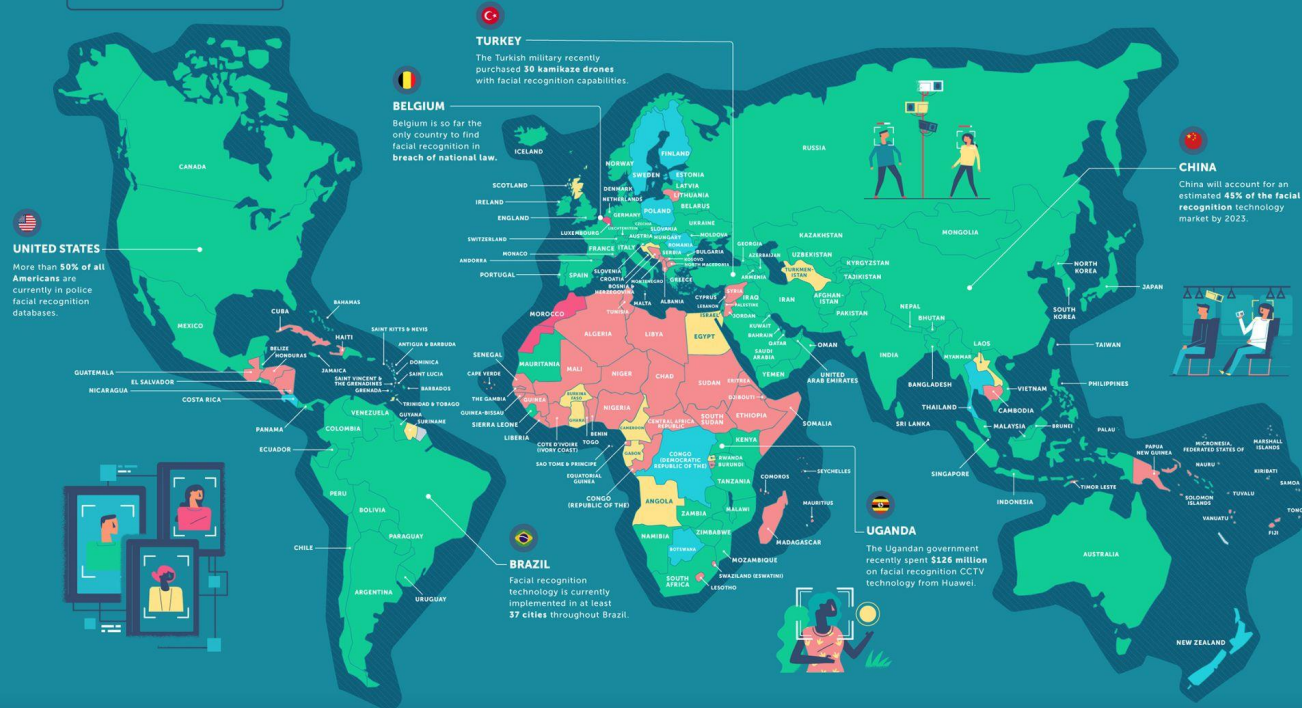- APPROVED FOR USE (NOT IMPLEMENTED)
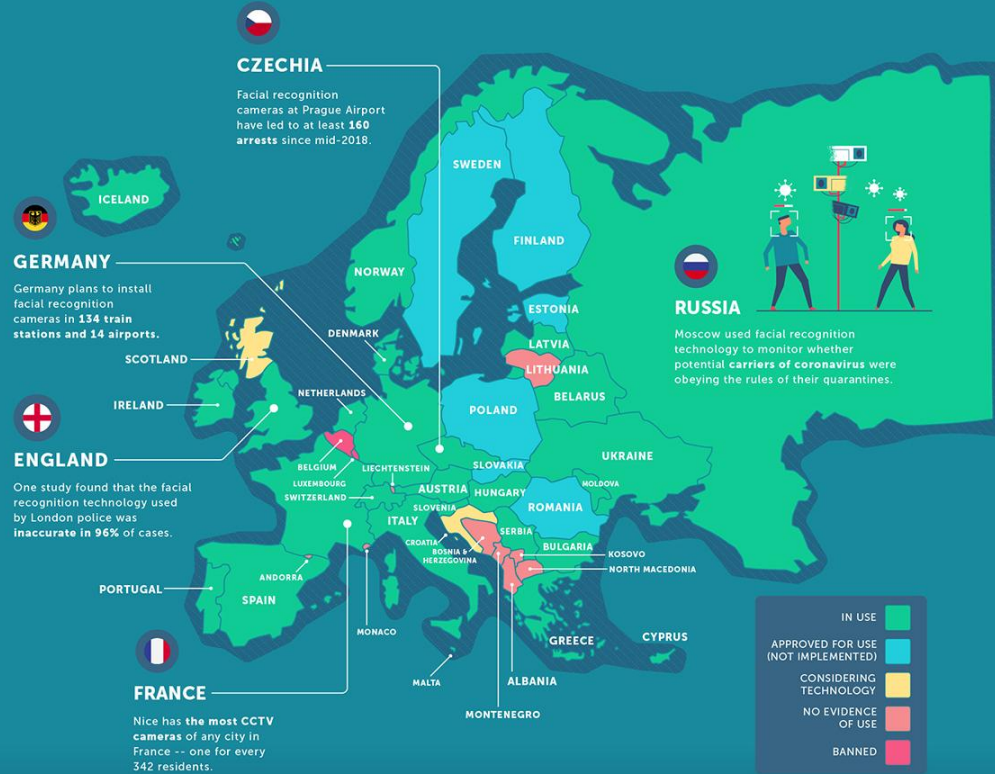- CONSIDERING TECHNOLOGY
- NO EVIDENCE OF USE
- BANNED

TURKEY
The Turkish military recently purchased 30 kamikaze drones with facial recognition capabilities.

BELGIUM
Belgium is so far the only country to find facial recognition in breach of national law.

CHINA
China will account for an estimated 45% of the facial recognition technology market by 2023.

UNITED STATES
More than 50% of all Americans are currently in police facial recognition databases.

BRAZIL
Facial recognition technology is currently implemented in at least 37 cities throughout Brazil.

UGANDA
The Ugandan government recently spent $126 million on facial recognition CCTV technology from Huawei.

SOURCES: Carnegie Endowment for International Peace, Electronic Frontier Foundation, AlgorithmWatch. Data collected in March 2020. For the full research behind this map, visit bit.ly/TheFacialRecognitionWorldMap

This image is licensed under the Creative Commons Attribution-Share Alike 4.0 International License - www.creativecommons.org/licenses/by-sa/4.0

Surfshark®

(Ghosh, 2020)

5

THE FACIAL RECOGNITION
MAP OF NORTH AMERICA

Legend:
- IN USE
- APPROVED FOR USE (NOT IMPLEMENTED)
- CONSIDERING TECHNOLOGY
- NO EVIDENCE OF USE
- BANNED

UNITED STATES
The U.S. Department of Homeland Security expects to conduct facial recognition scans on **97% of all air travelers** by 2023.

BAHAMAS
The Bahamas recently used facial recognition technology to search for **missing persons** in the wake of Hurricane Dorian.

PANAMA
The facial recognition cameras at Panama's Tocumen Airport identify an average of **30 people** wanted by police per day.

CANADA

MEXICO

CUBA

HAITI

BELIZE

HONDURAS

JAMAICA

GUATEMALA

EL SALVADOR

NICARAGUA

COSTA RICA

SAINT KITTS & NEVIS

ANTIGUA & BARBUDA

DOMINICA

SAINT LUCIA

SAINT VINCENT & THE GRENADINES

BARBADOS

GRENADA

TRINIDAD & TOBAGO

(Ghosh, 2020)

6

THE FACIAL RECOGNITION
MAP OF EUROPE

CZECHIA

Facial recognition cameras at Prague Airport have led to at least **160 arrests** since mid-2018.

GERMANY

Germany plans to install facial recognition cameras in **134 train stations and 14 airports.**

ENGLAND

One study found that the facial recognition technology used by London police was **inaccurate in 96%** of cases.

FRANCE

Nice has **the most CCTV cameras** of any city in France -- one for every 342 residents.

RUSSIA

Moscow used facial recognition technology to monitor whether potential **carriers of coronavirus** were obeying the rules of their quarantines.

ICELAND
SWEDEN
NORWAY
FINLAND
DENMARK
ESTONIA
LATVIA
LITHUANIA
BELARUS
SCOTLAND
IRELAND
NETHERLANDS
POLAND
BELGIUM
LIECHTENSTEIN
SLOVAKIA
UKRAINE
LUXEMBOURG
SWITZERLAND
AUSTRIA
HUNGARY
MOLDOVA
SLOVENIA
ITALY
ROMANIA
CROATIA
SERBIA
BOSNIA & HERZEGOVINA
BULGARIA
KOSOVO
NORTH MACEDONIA
ANDORRA
PORTUGAL
SPAIN
MONACO
GREECE
CYPRUS
MALTA
ALBANIA
MONTENEGRO

Legend:
- IN USE
- APPROVED FOR USE (NOT IMPLEMENTED)
- CONSIDERING TECHNOLOGY
- NO EVIDENCE OF USE
- BANNED

Surfshark®

(Ghosh, 2020)

THE FACIAL RECOGNITION
MAP OF EAST ASIA & OCEANIA

Legend:
- IN USE
- APPROVED FOR USE (NOT IMPLEMENTED)
- CONSIDERING TECHNOLOGY
- NO EVIDENCE OF USE
- BANNED

CHINA
China has about **170 million CCTV surveillance cameras** installed throughout the country -- approximately one for every 12 citizens.

JAPAN
Stores using facial recognition cameras in Japan experienced a **40% decrease** in shoplifting incidents compared to stores without the technology.

MACAU
Approximately **2 in every 3 casino** operators in Macau are currently using or testing facial recognition technology.

AUSTRALIA
Australia has proposed using facial recognition technology to verify the ages of people seeking to **watch pornography** online.

Map labels: MONGOLIA, NORTH KOREA, SOUTH KOREA, NEPAL, BHUTAN, INDIA, LAOS, TAIWAN, MYANMAR, BANGLADESH, THAILAND, VIETNAM, PHILIPPINES, CAMBODIA, SRI LANKA, MALAYSIA, BRUNEI, PALAU, MICRONESIA, FEDERATED STATES OF, MARSHALL ISLANDS, PAPUA NEW GUINEA, NAURU, KIRIBATI, SINGAPORE, TIMOR LESTE, INDONESIA, SOLOMON ISLANDS, TUVALU, SAMOA, TONGA, VANUATU, FIJI, AUSTRALIA, NEW ZEALAND

(Ghosh, 2020)

8

THE FACIAL RECOGNITION
MAP OF AFRICA

Legend:
- IN USE
- APPROVED FOR USE (NOT IMPLEMENTED)
- CONSIDERING TECHNOLOGY
- NO EVIDENCE OF USE
- BANNED

MOROCCO
In September 2019, Morocco issued a temporary, seven-month **moratorium** on the use of facial recognition technology.
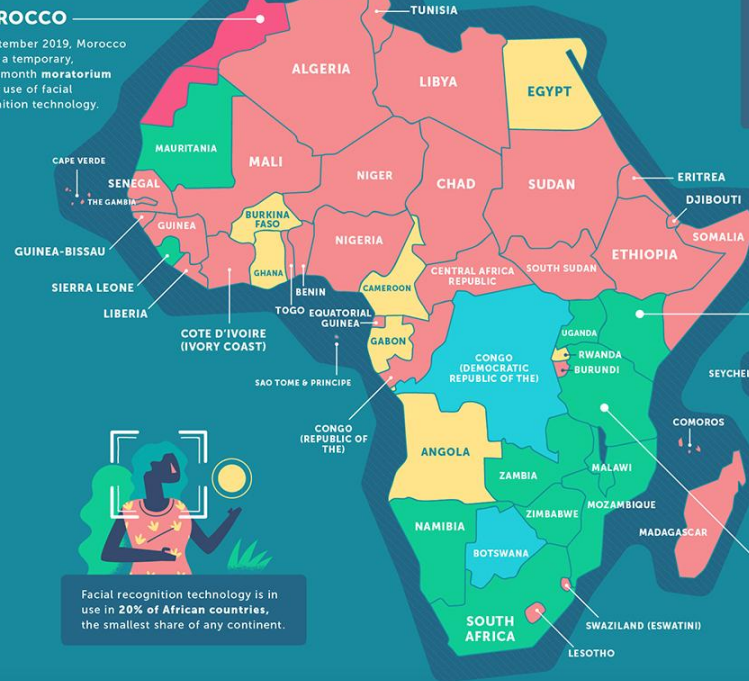
KENYA
According to Huawei, surveillance cameras installed in Nairobi, Kenya led to **a 46% decrease in crime** in 2015.

TANZANIA
Tanzania is currently testing a facial recognition app that can help **identify dogs** that have been vaccinated for rabies.

Facial recognition technology is in use in **20% of African countries,** the smallest share of any continent.

Country labels: TUNISIA, ALGERIA, LIBYA, EGYPT, MAURITANIA, MALI, NIGER, CHAD, SUDAN, ERITREA, DJIBOUTI, CAPE VERDE, SENEGAL, THE GAMBIA, GUINEA, BURKINA FASO, NIGERIA, SOMALIA, GUINEA-BISSAU, GHANA, CENTRAL AFRICA REPUBLIC, SOUTH SUDAN, ETHIOPIA, SIERRA LEONE, BENIN, CAMEROON, LIBERIA, TOGO, EQUATORIAL GUINEA, COTE D'IVOIRE (IVORY COAST), GABON, UGANDA, RWANDA, BURUNDI, SEYCHELLES, SAO TOME & PRINCIPE, CONGO (DEMOCRATIC REPUBLIC OF THE), CONGO (REPUBLIC OF THE), COMOROS, ANGOLA, MAURITIUS, ZAMBIA, MALAWI, MOZAMBIQUE, ZIMBABWE, NAMIBIA, MADAGASCAR, BOTSWANA, SOUTH AFRICA, SWAZILAND (ESWATINI), LESOTHO, TANZANIA

Surfshark®

(Ghosh, 2020)

Facial Recognition is hard!

We tried a variety of different models of methods of implementation for this project

Ultimately, only one of them really worked
- ○ Clarifai

Common problems we encountered:
- Endless package installations
  - ○ Some no longer available
- Extremely complicated GitHub documentation
- Lack of a CUDA-rated processor
- Lack of general processing power
- Operating system conflicts
  - ○ Most things strangely developed for Linux and MacOS
- Directory complications (source code, binary directories, etc.)

ENTER IMAGE URL

https://i.pinimg.com/474x/f0/f8/18/f0f81827
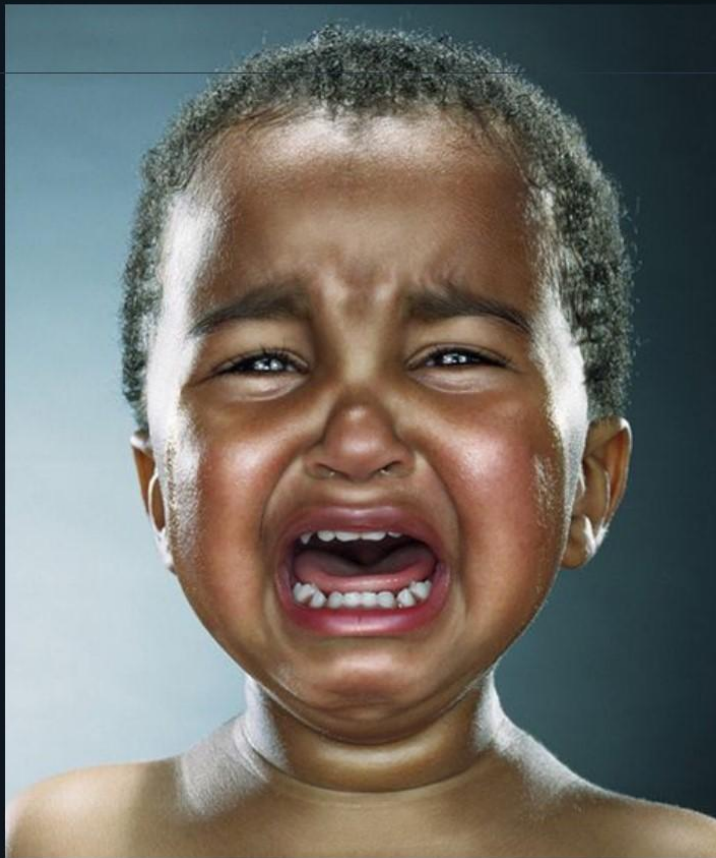
Predict

⌄ PREDICTIONS

SADNESS-CONTEMPT	1.00
HAPPINESS	0.00
SURPRISE	0.00
DISGUST	0.00
FEAR	0.00
ANGER	0.00
NEUTRAL	0.00
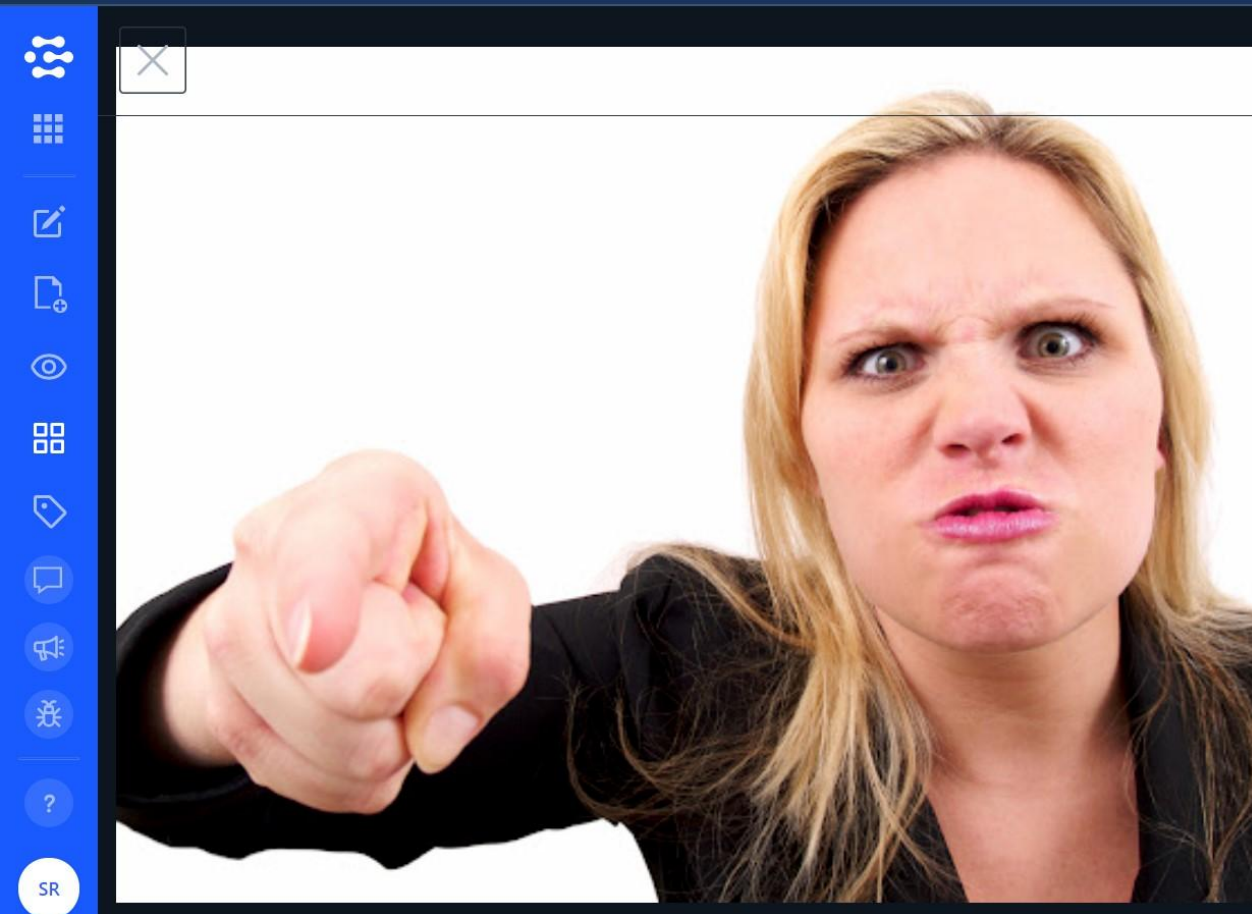
ENTER IMAGE URL

https://lh3.googleusercontent.com/proxy/Q

Predict

˅ PREDICTIONS

NEUTRAL	0.90
SURPRISE	0.10
HAPPINESS	0.00
ANGER	0.00
FEAR	0.00
DISGUST	0.00
SADNESS-CONTEMPT	0.00

ENTER IMAGE URL

https://www.faithful-to-nature.co.za/blog/w|
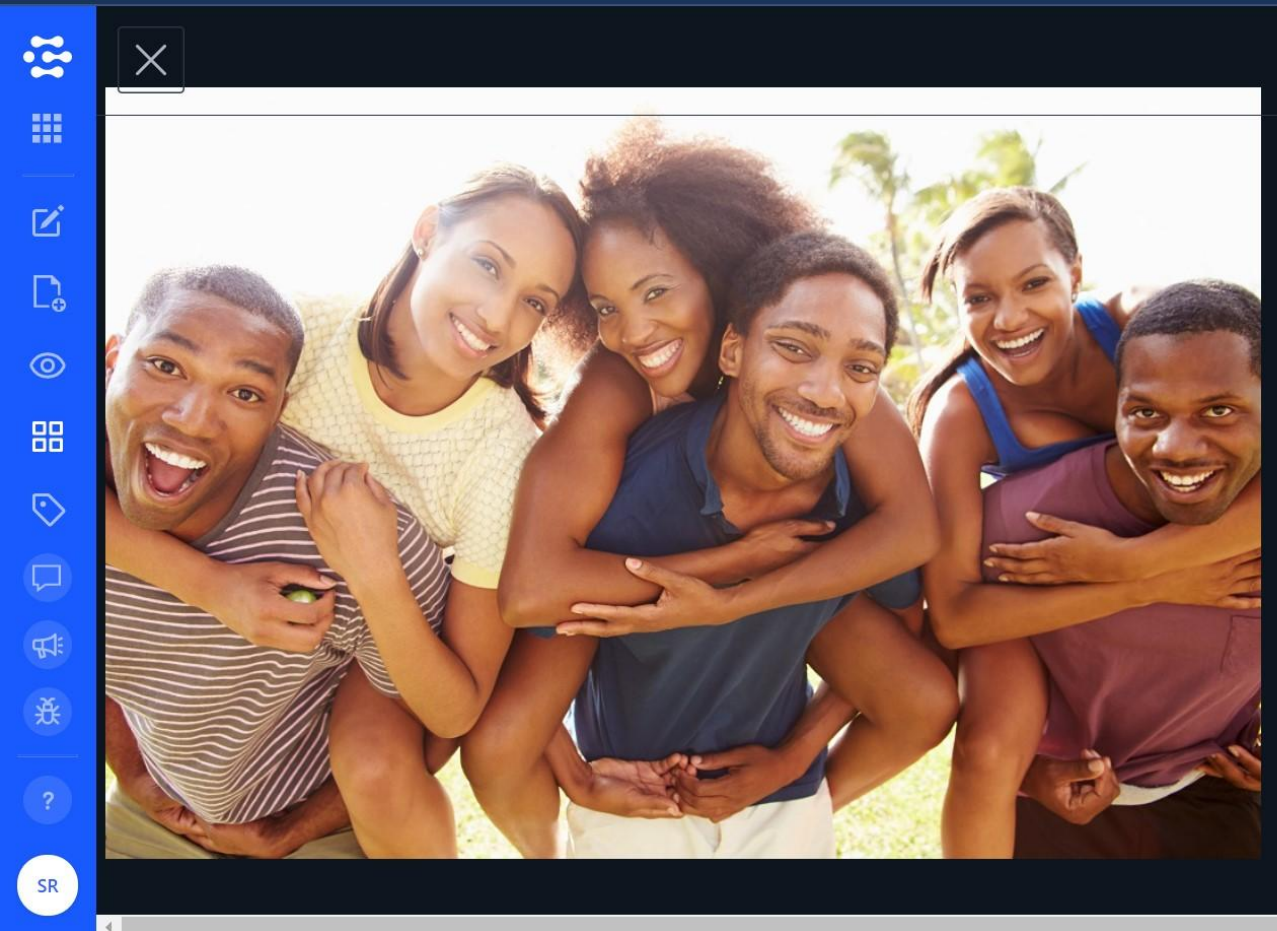
Predict

PREDICTIONS

ANGER	0.40
SURPRISE	0.24
HAPPINESS	0.02
NEUTRAL	0.00
FEAR	0.00
DISGUST	0.00
SADNESS-CONTEMPT	0.00

PREDICTIONS

CROISSANT	1.00
PASTRY	0.92
BREAD	0.59
BUTTER	0.51
DOUGH	0.11
BRIOCHE	0.03
CHOCOLATE	0.03
COOKIE	0.01
ALMOND	0.01
CRESCENT ROLL	0.00
DANISH PASTRY	0.00
SAUSAGE ROLL	0.00
MACARONI	0.00

Areas for more Research

- A deeper dive into the biases of facial recognition software

- Different methods of facial recognition

- Facial recognition and identity theft,

   how easy is it to fake out?
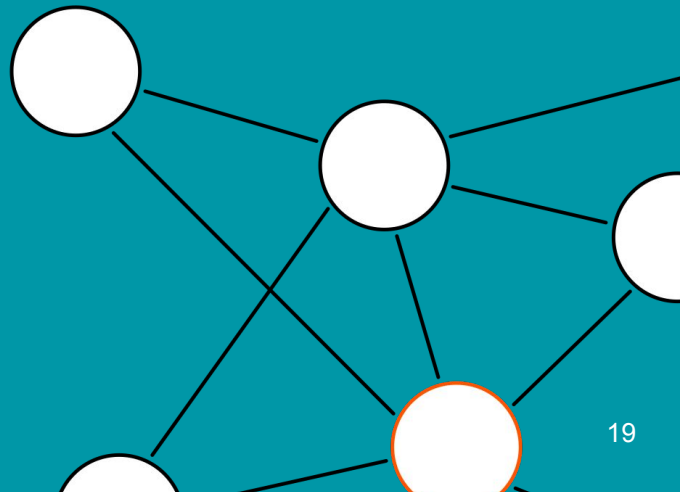
Citations

Ghosh, Iman. "Mapped: The State of Facial Recognition Around the World." *Visual Capitalist*, 23 May 2020,
    https://www.visualcapitalist.com/facial-recognition-world-map/.

Kostka, Genia, et al. "Between Security and Convenience: Facial Recognition Technology in the Eyes of Citizens in China, Germany, the

    United Kingdom, and the United States." *Public Understanding of Science*, vol. 30, no. 6, Aug. 2021, pp. 671–690,

    doi:10.1177/09636625211001555.

Geitgey, Adam. "Face_recognition." *GitHub*, 13 Feb. 2021, https://github.com/ageitgey/face_recognition/blob/master/README.md.