GDCC

Government Data Center and Cloud Service

Facial Recognition Solution

API Services, Use Cases, and Applications

Outline

1. AI in a Nutshell

2. Computer Vision and its Applications

3. How does Facial Recognition Work?

4. Facial Recognition Use Cases

5. Facial Verification API Service on GDCC

6. Contact for API Request on GDCC

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AI in a Nutshell

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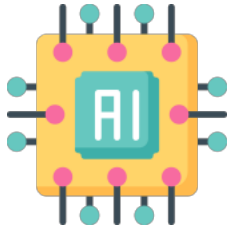
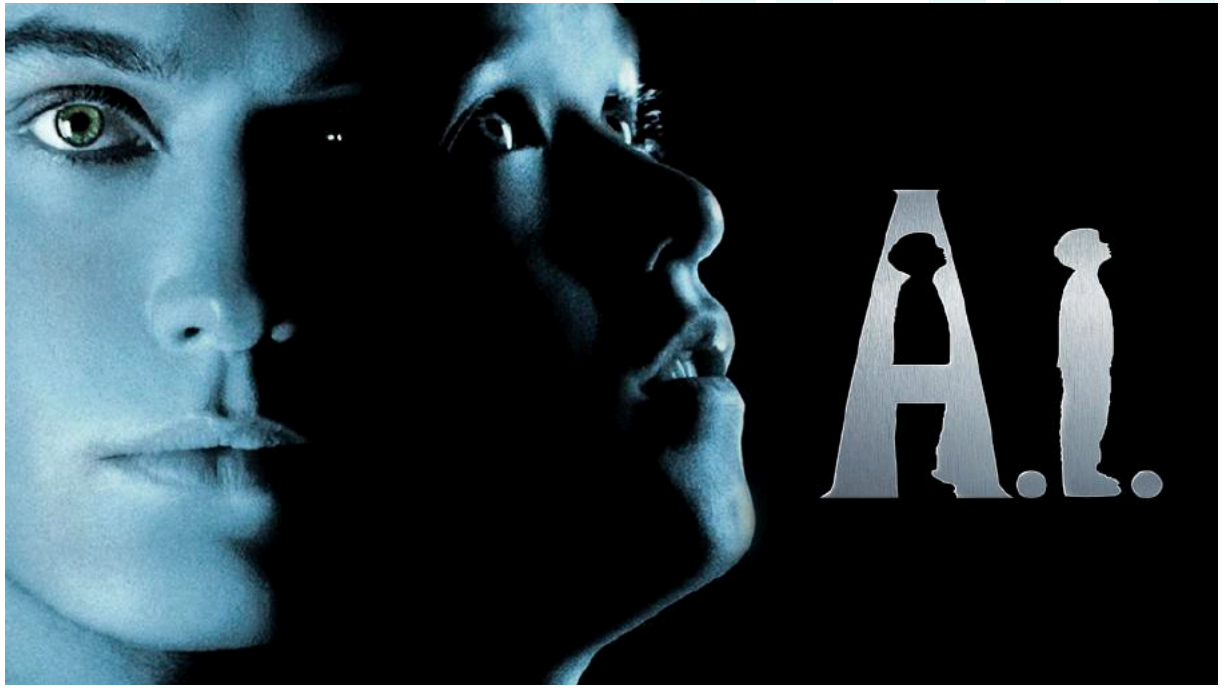
What Exactly is AI?



AI (Artificial + Intelligence)

"Any **device** that **perceives its environment** and takes actions that **maximize its chance** of successfully achieving its goals"



Artificial Intelligence (2001) by Stanley Kubrick and Steven Spielberg

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Major Subfields of AI

Machine Learning :

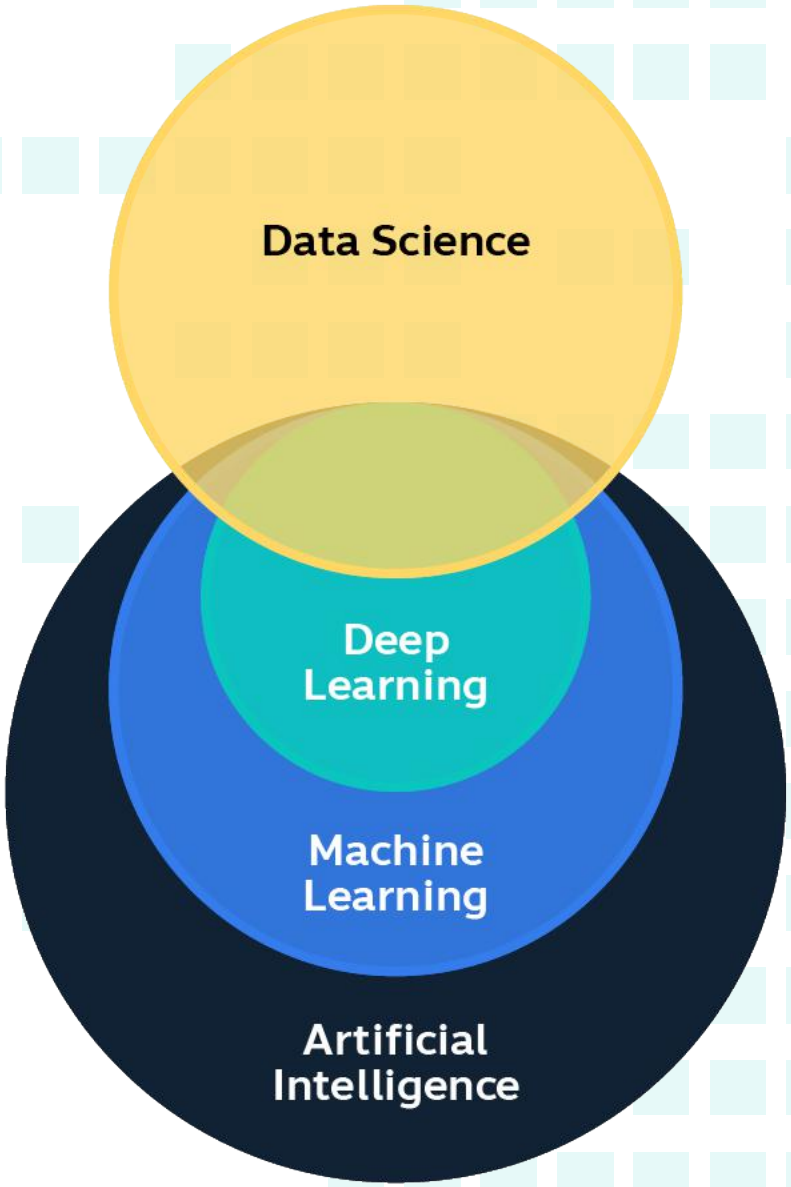
Automatic self-learning system

Deep Learning :

Machine Learning with a core algorithm that mimics human brain's learning process

Data Science :

Field of study that combines domain expertise and knowledge in machine learning to extract meaningful insights from data



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Computer Vision and its Applications

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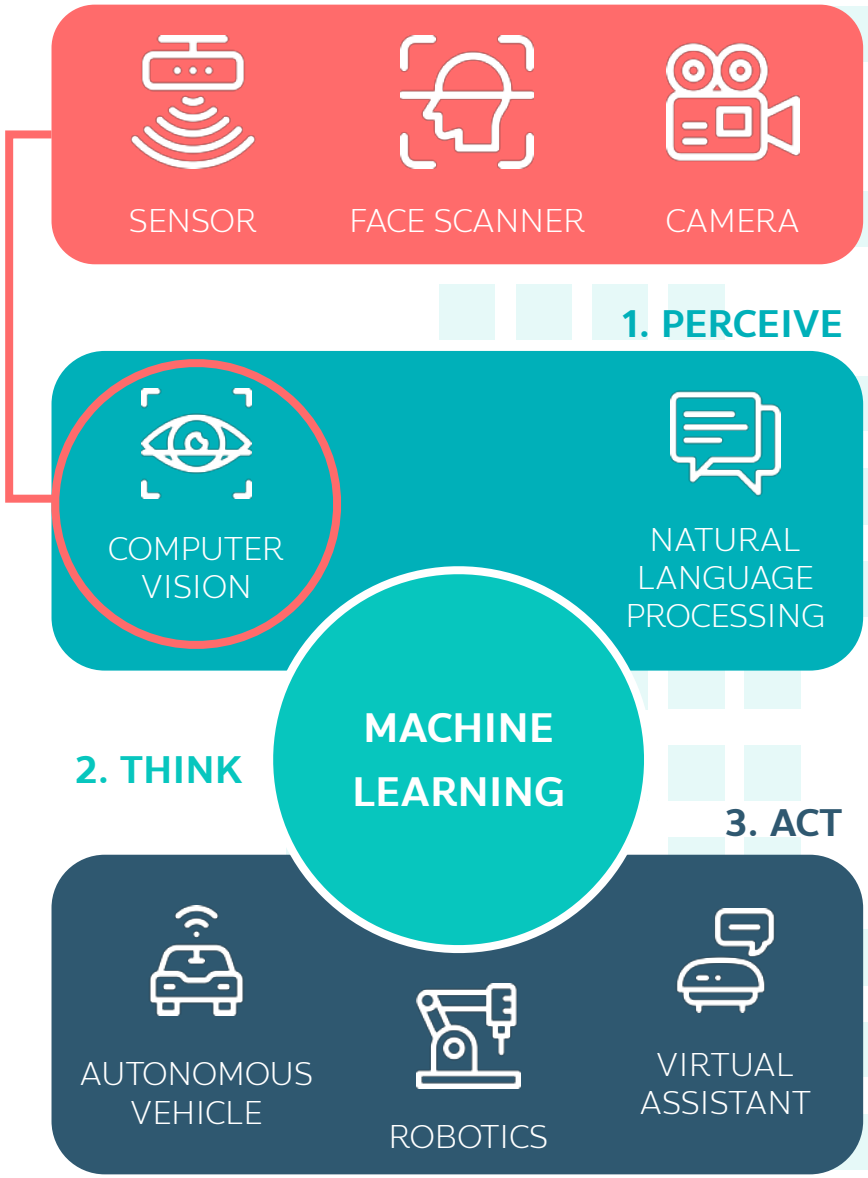
AI's Perception System

- Computer Vision can be thought of as a **perceptual module** of an intelligence system.
- It is applied at the stage where we make sense of meaningful data from various **sensing devices.**



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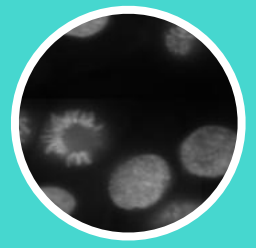
What Counts as Computer Vision?

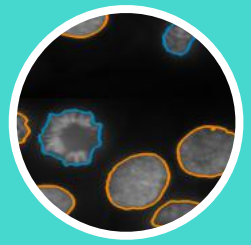
From (Literally) the Smallest Things …

- Computer Vision is applied to help **annotate microbe samples.**
- This saves huge amount of time (from hours to just **a few minutes**), meaning we can have medicine and vaccine ready much faster!

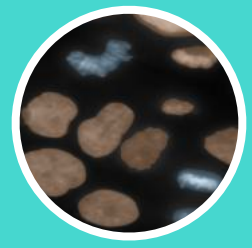
Super-Resolution Microscopy Imaging



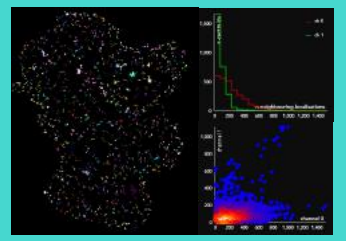
Input



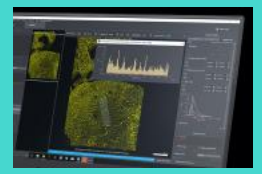
Minimal user annotations

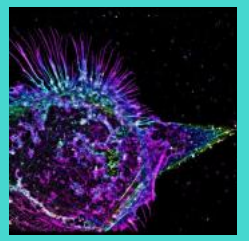


Automatically locates new examples



High-throughput quantification





Interactive visualisation

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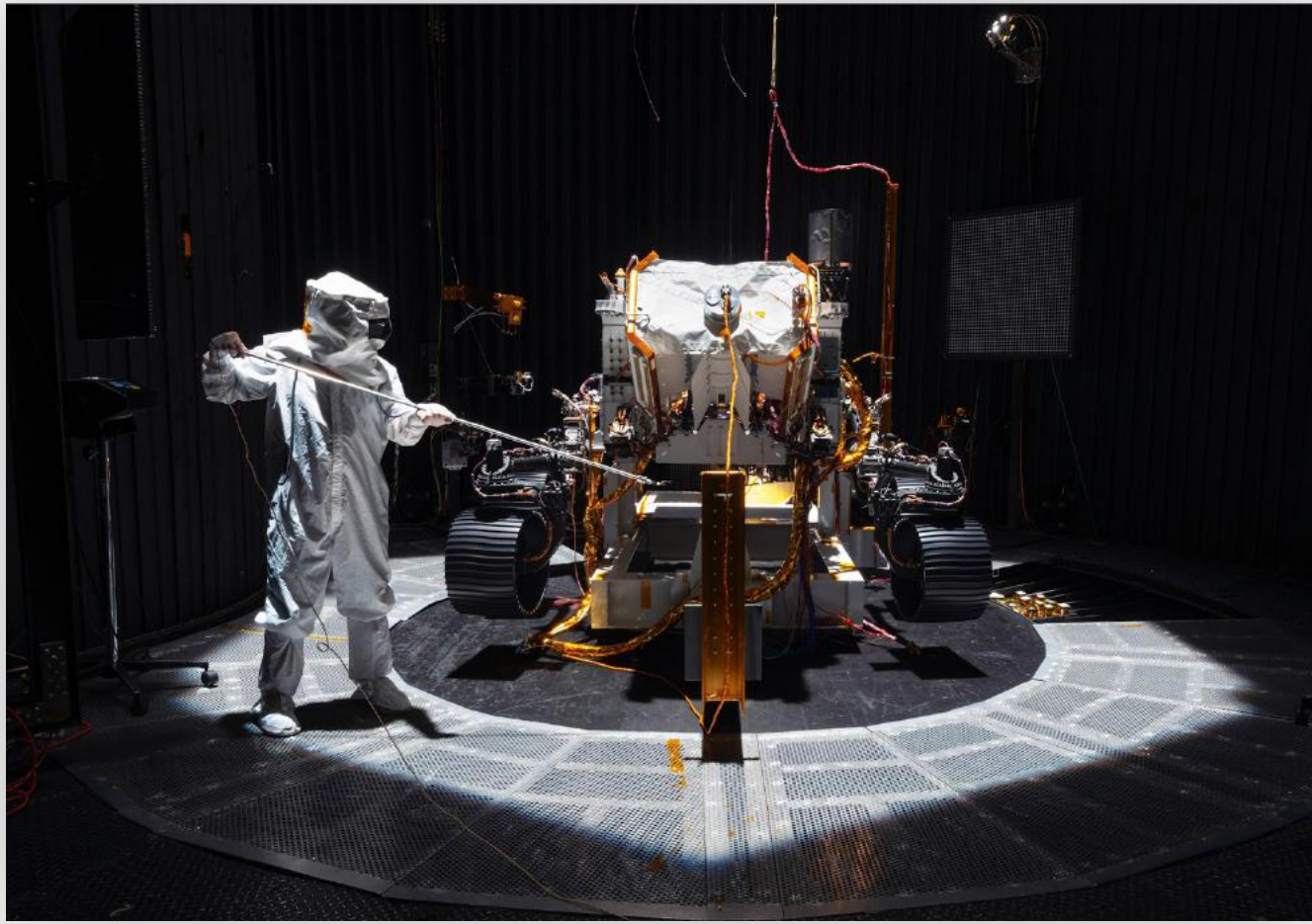
What Counts as Computer Vision?

.. To the Largest Project in Human History

- Computer Vision is applied to **process image data** to steer a self-driving car autonomously towards each stop on the Mars.

- The navigation module can **predict the path to destination** and avoid any obstacle along the way.



NASA's Self-Driving Car "Perseverance" for Next Mars Mission

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What Counts as Computer Vision?

Facial Recognition

- Computer Vision is applied to extract **unique features** on our face and embed them into vector form that can be used to search for a positive match in a database.

- Facial Recognition is widely adopted as a **biometric authentication tool** to unlock a smart phone. It is a **sanitary alternative** to fingerprint scanner.

Why Facial Recognition Systems Could Rise In Popularity During Coronavirus Pandemic

Security companies are updating their technology to recognize people wearing masks and measure temperatures, showing how facial recognition could become widely sought as a global security solution.

By Haley Samsel | Mar 20, 2020

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Computer Vision in Trending

- Computer Vision is one of the **top 3 areas of AI** that has been widely adopted in all industrial sectors.

- Excluding the obvious High Tech,
  - ❖ Leading industries are **Automotive, Telecom, and Logistics.**
  - ❖ Growth industries are **Retail, Logistics, and Electric Power**

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Key Factors for Business Growth

.. In 2025, retail owners are expected to spend **US$34 billion** on AI technologies, up from **US$4 billion** in 2018...

Computer vision will account for 29% of this spending...

- ABI Research -

Productivity Boost

- **Reduced Costs:** save expense of man-hours and time spent on task execution and planning.
- **Operating Benefits:** increase production rate and improve inspection quality

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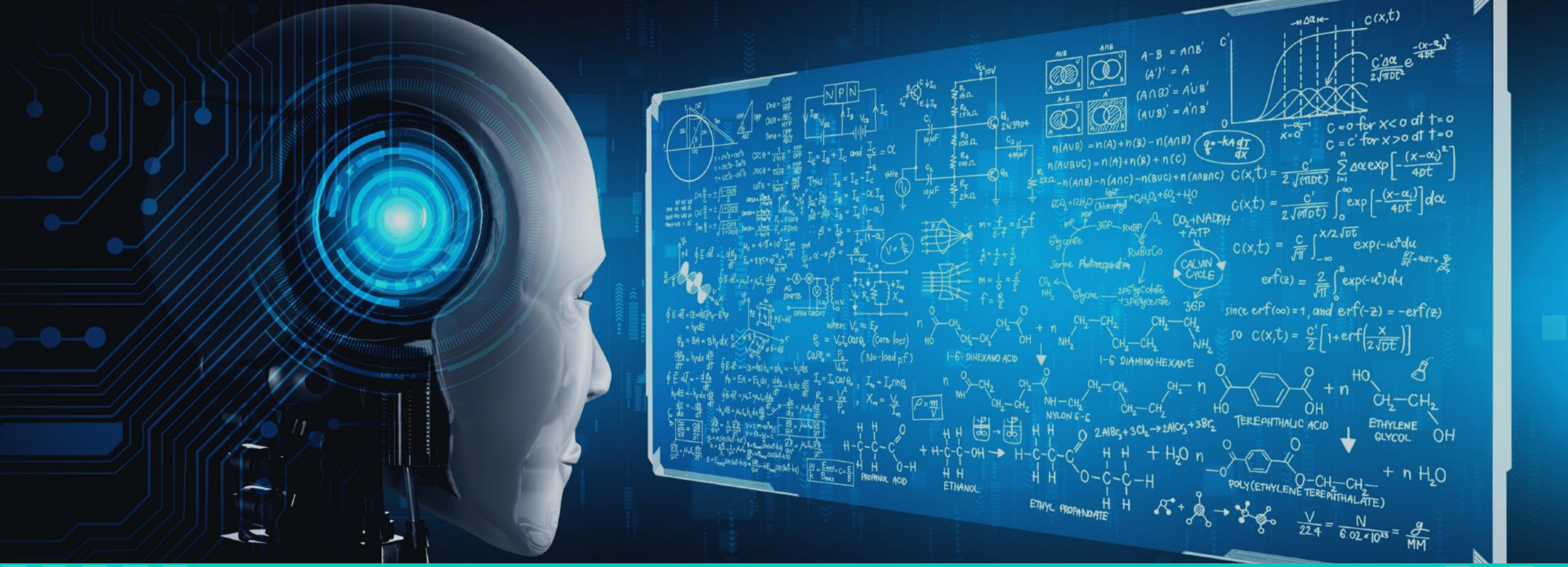

How does Facial Recognition Work?

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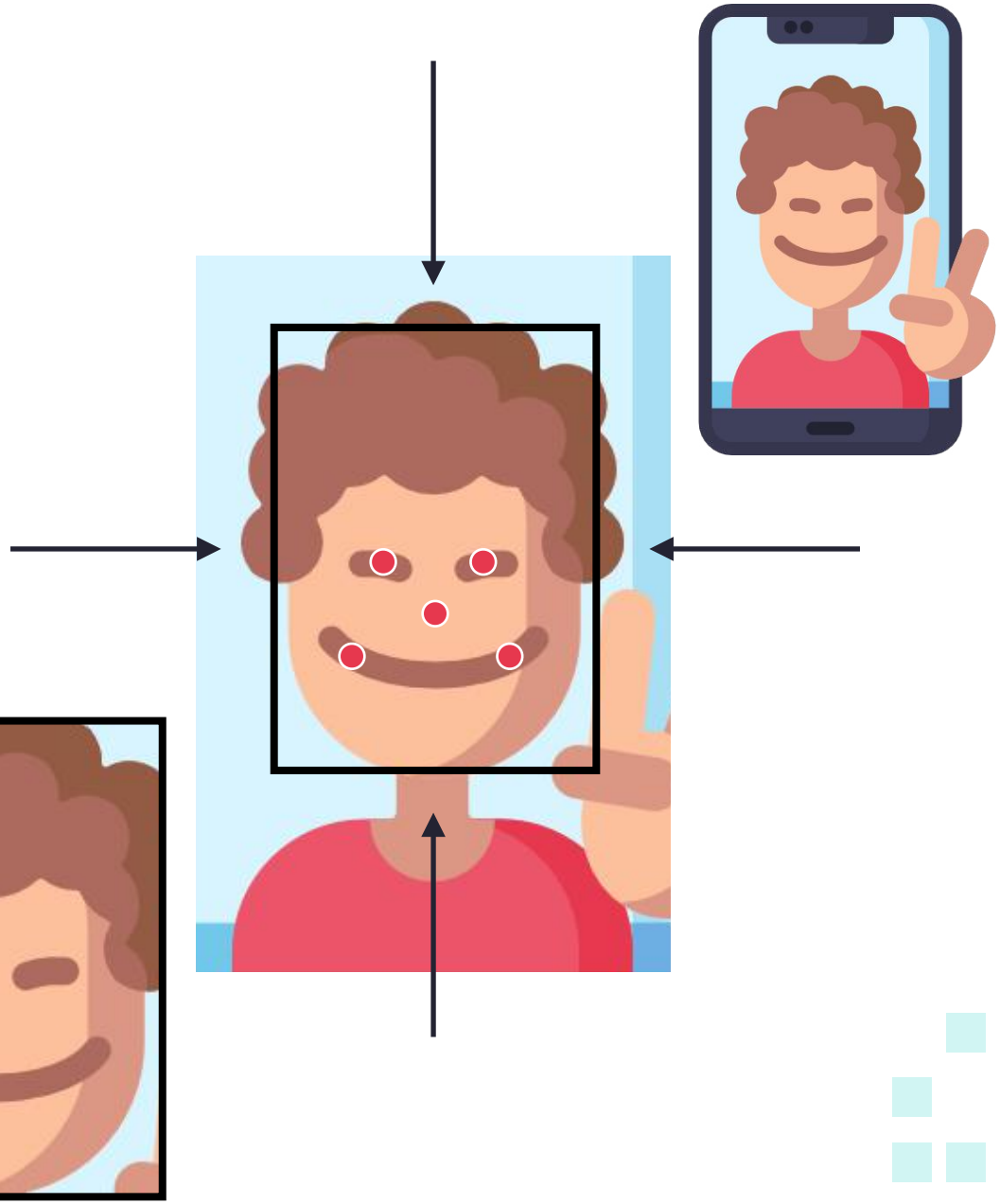
Step 1: Locating Face

- Identify **facial landmarks** (e.g. eyes, nose, and mouth) in an image

- Use these landmarks to **locate face**



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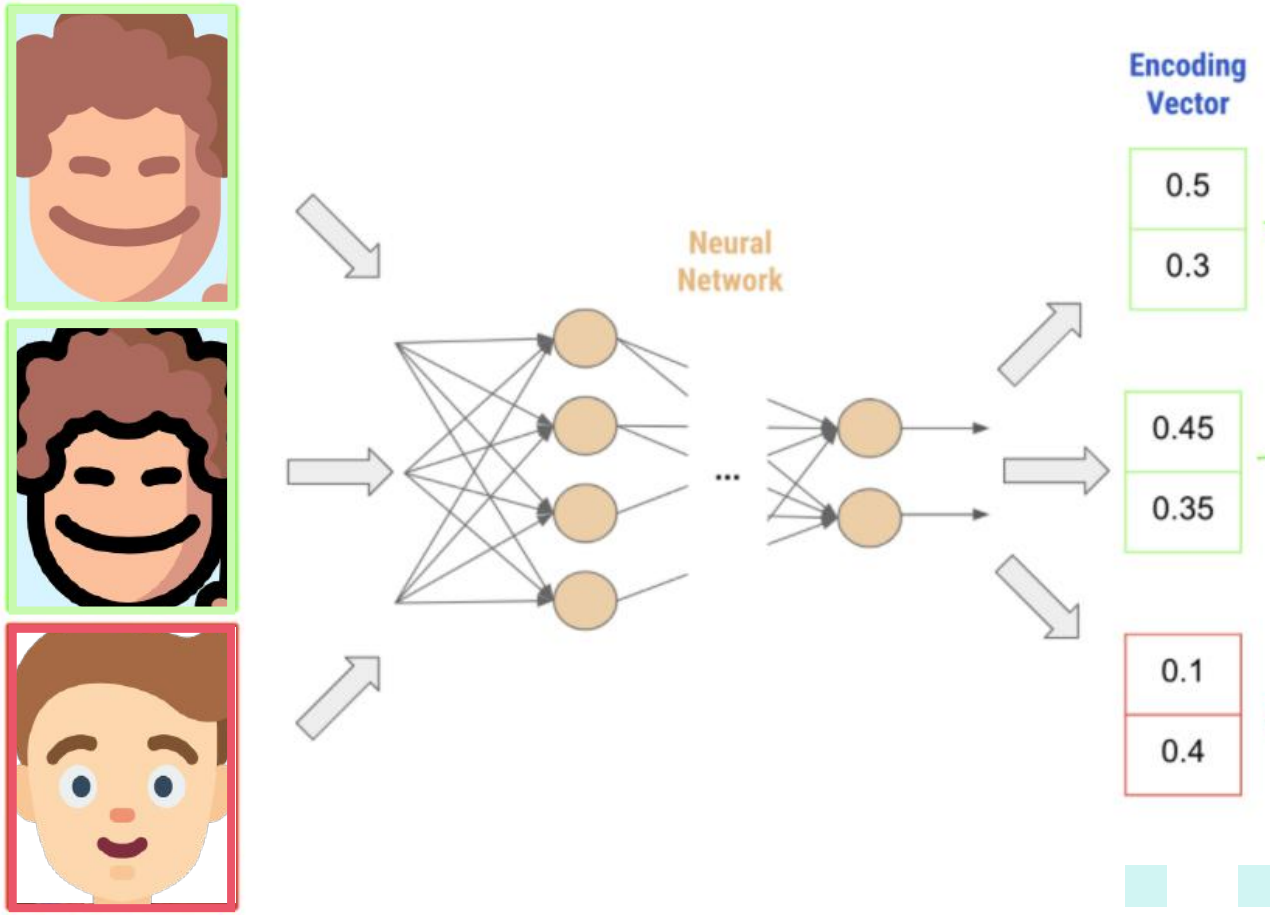
Step 2: Embedding Facial Data into Vector

- Apply **neural network** to embed facial data into **vector** (set of numbers)
- Facial images from the same person will be mapped by network model to a set of **similar numbers**



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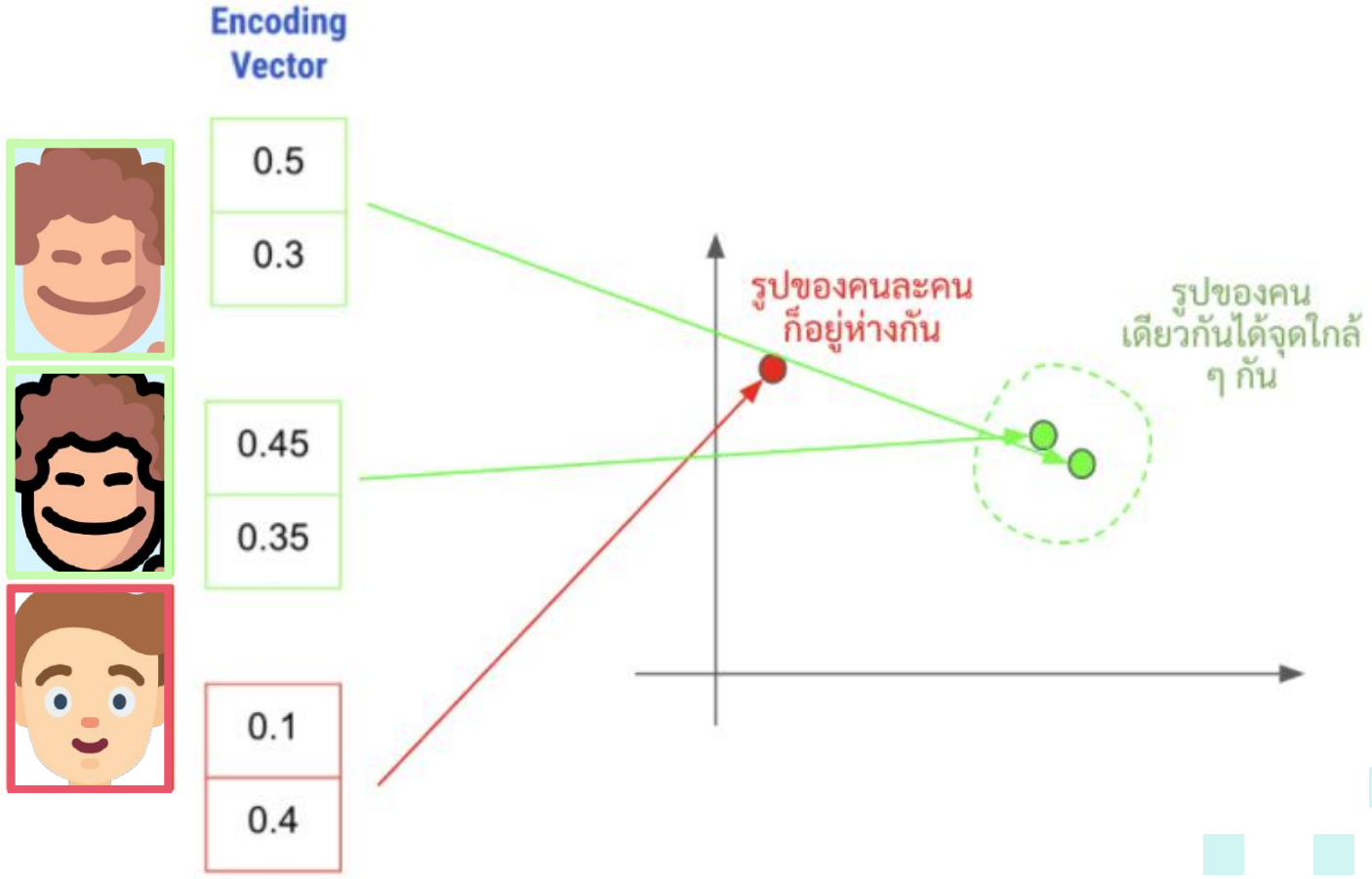
Step 3: Comparing Vectors

- Two different vectors can be distinguished by doing a cross check for **similarity**

- To recognize facial sample, there should be a **reference embedding vector** (processed from a reliable source, such as ID card and driving license) stored in a database



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Performance Metrics & e-KYC Standard

- **False Acceptance Rate (FAR):** ↓ FAR, ↑ Security

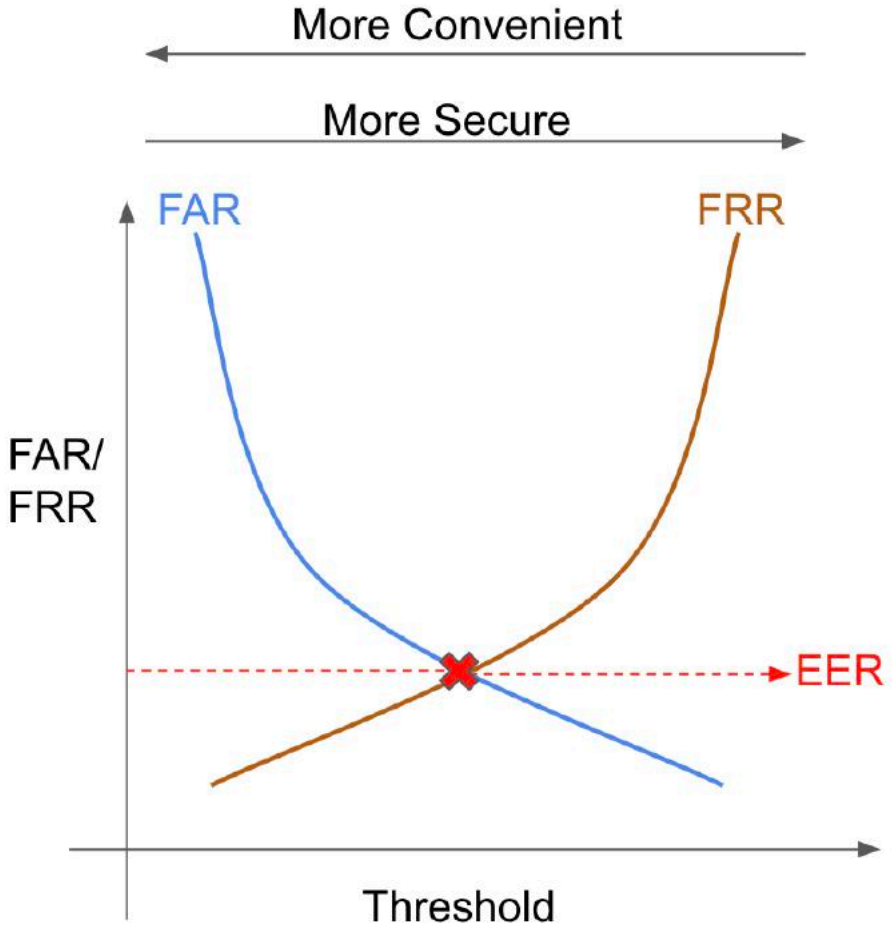
Likelihood that system will **incorrectly accept** an access attempt from an **unauthorized user**

Bank of Thailand's e-KYC Standard: < 0.1%

- **False Rejection Rate (FRR):** ↓ FRR, ↑ Convenience

Likelihood that system will **incorrectly reject** an access attempt from an **authorized user**

Bank of Thailand's e-KYC Standard: < 3%



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Facial Recognition Performance

- Use RetinaNet and fine tune to achieve **95% accuracy in locating face**
- Use neural network to embed facial data into **128-dimensional vector**
- Comply with Bank of Thailand's e-KYC Standard **(FAR = 0.1%, FRR = 0.292% < 3%)**

LABELLED FACES IN THE WILD (LFW) (Optimal Threshold 0.301)

Number of Samples: 13,000

Metric	Mean	SD
Accuracy	99.819%	0.00957%
FRR	0.0562%	0.00735%
FAR	0.306%	0.0158%
F1	99.819%	0.00957%
AUC	99.964%	0.00355%

Metric		Value	Threshold
EER		0.231%	0.2622
FRR (@FAR=0.1%)	Level 1	0.292%	0.2891
FRR (@FAR=0.01%)	Level 2	0.550%	0.3549
FRR (@FAR=0.001%)	Level 3	0.814%	0.3960
FRR (@FAR=0.0001%)	Level 4	1.55%	0.4475

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Facial Recognition Use Cases

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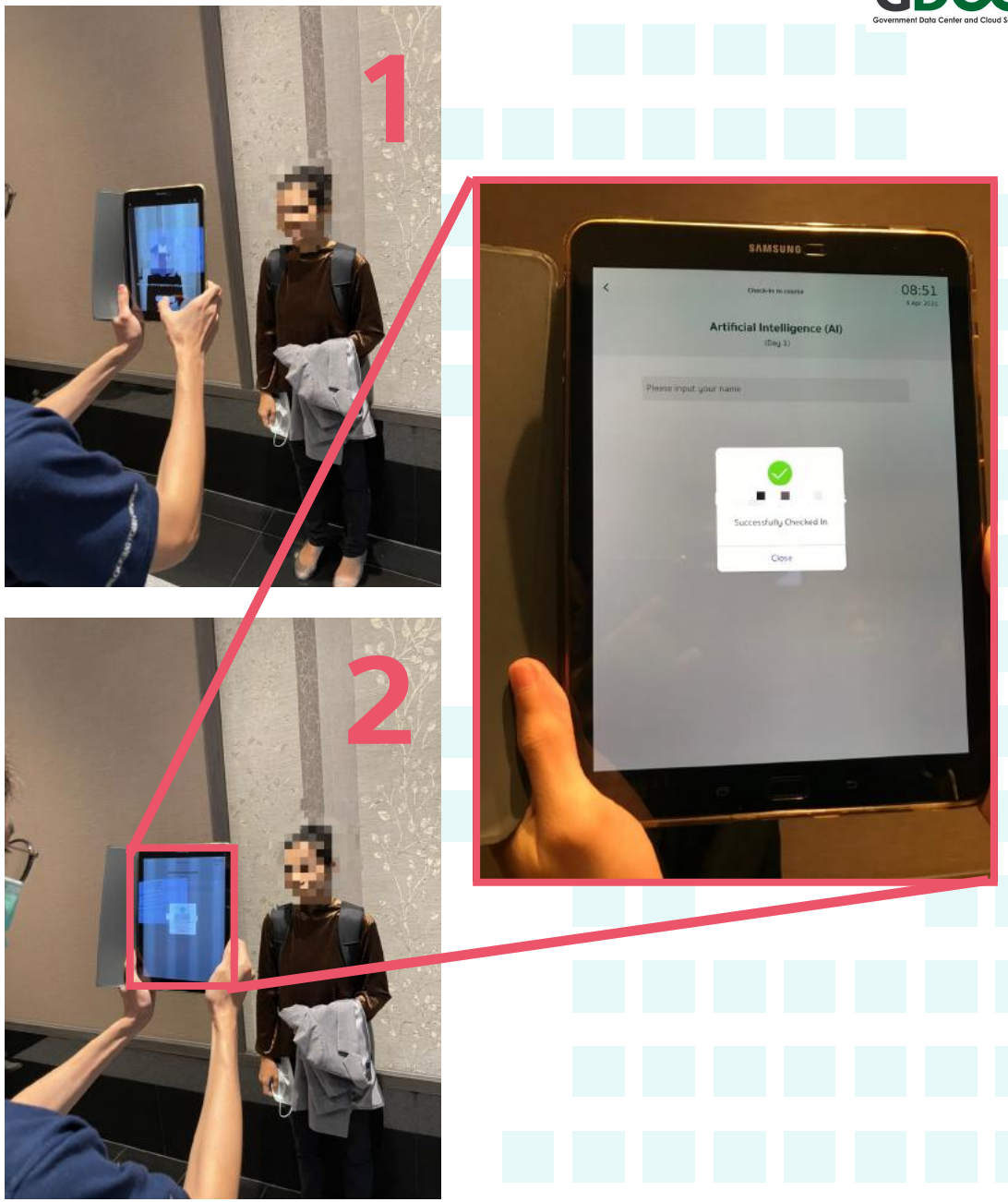
Smart Check-In

- GDCC applied **facial recognition** to check the **presence of attendees** in a seminar event.
- Attendees will be asked to do a **pre-registration** via GDCC APP by filling out their names and uploading profile photos.
- Staff will be on standby at a seminar location to take a photo of each attendee and call **API service on GDCC** for verifying their facial identities. Check-in will be processed accordingly.



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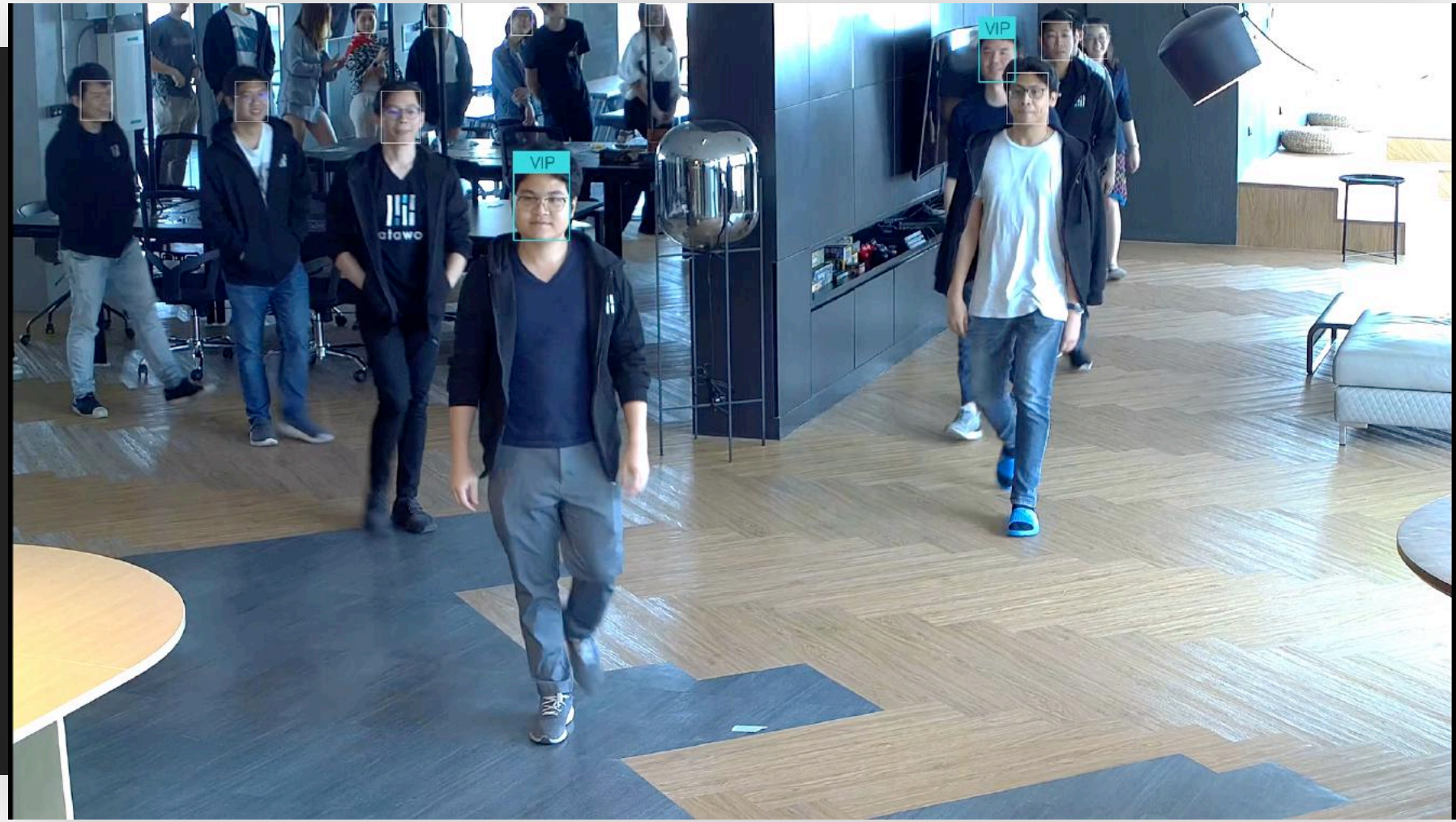
VIP/ Blacklist in Your Area!

ทำให้คุณสามารถรู้ก่อนใคร!

VIP หรือ Blacklist

With Real-Time API System



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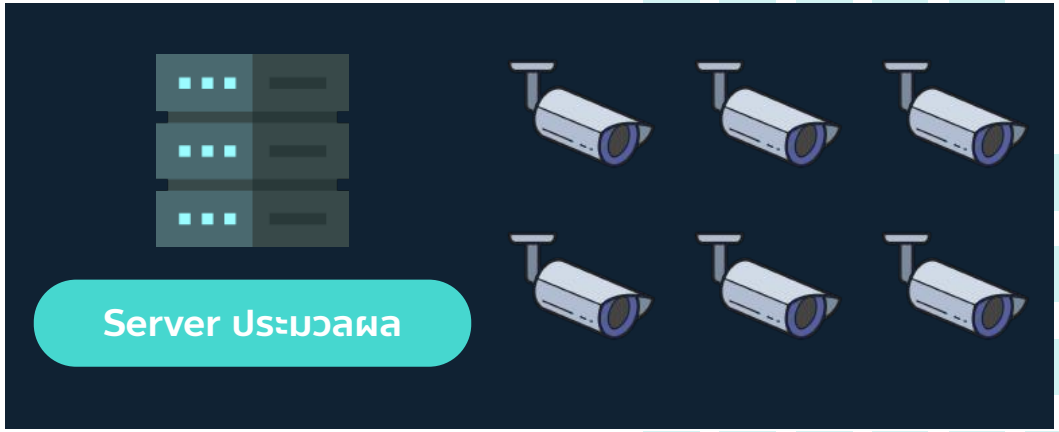
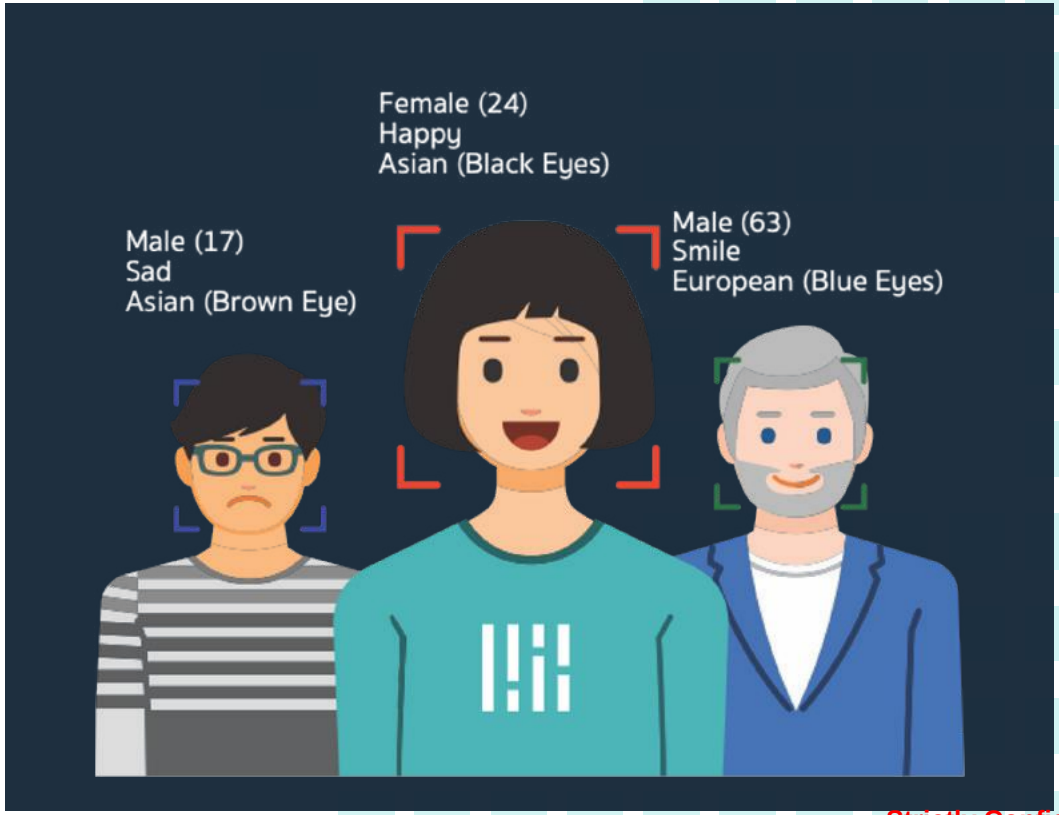
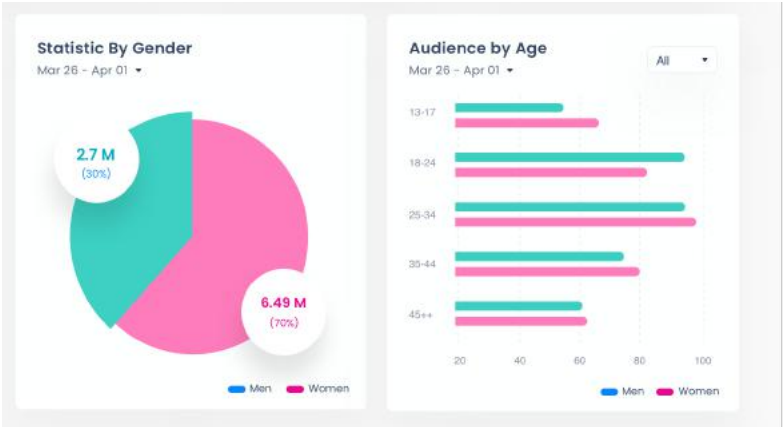
Facial Recognition Use Cases

Visitor Analysis

- ✓ Count **number of visitors** and rank **clusters** in each specific area.
- ✓ Predict **demographic data** (age, gender, and nationality).
- ✓ **Data-driven promotional campaign** that improves sales and customer engagement







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Facial Verification API Service on GDCC

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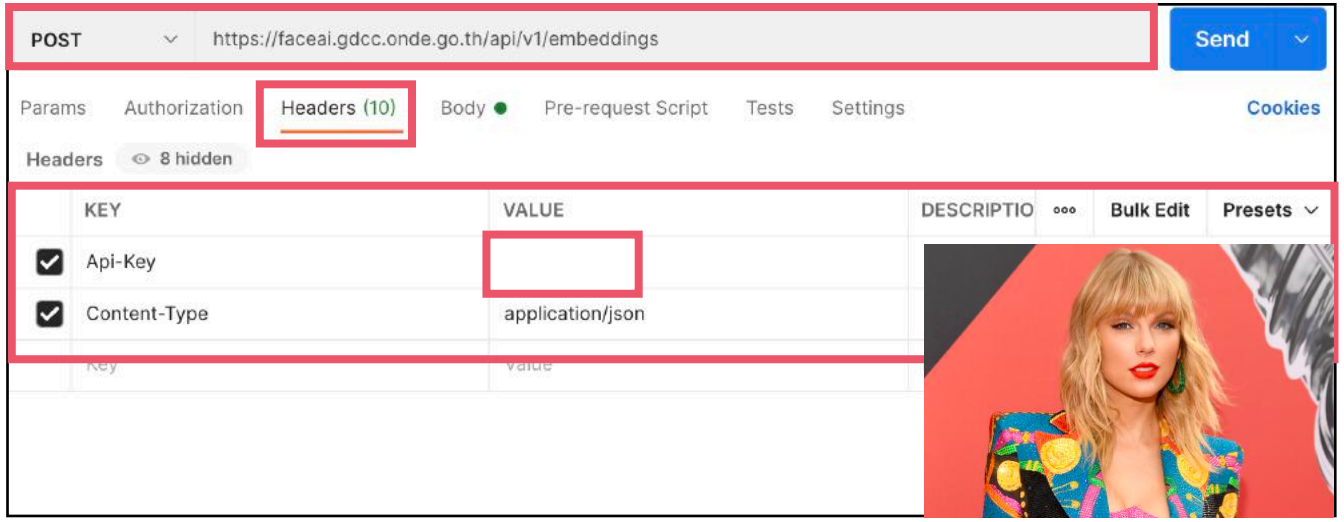
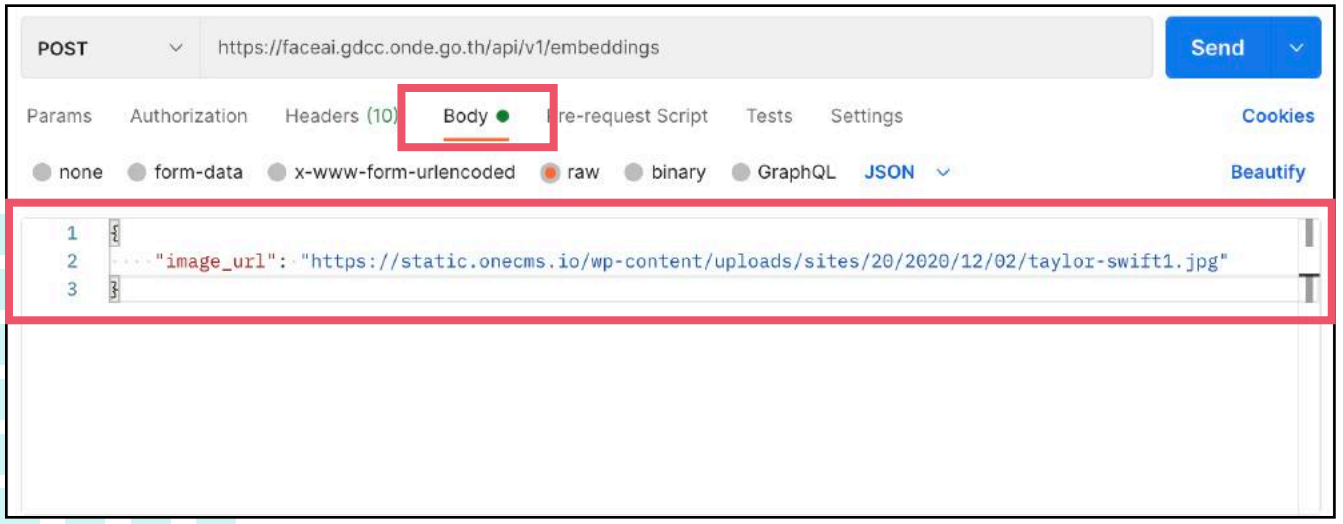
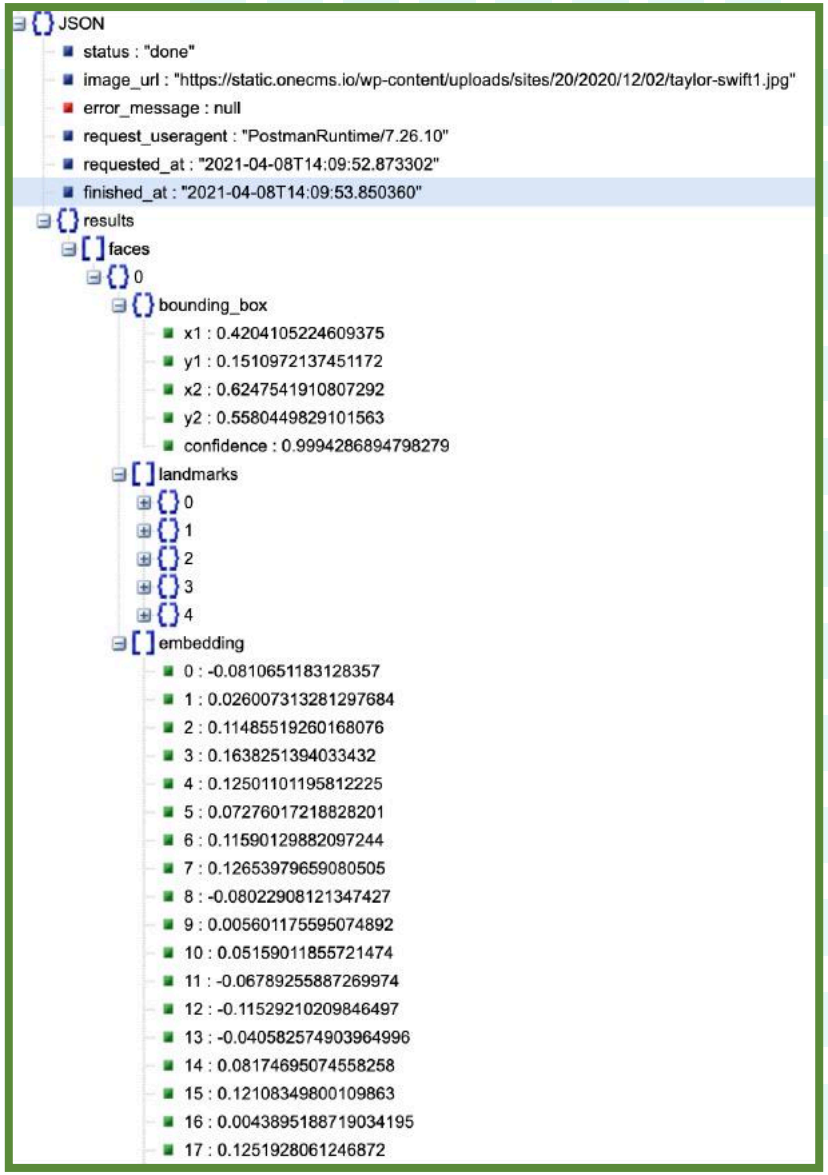
Face Embedding API







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Face Verification API

POST https://faceai.gdcc.onde.go.th/api/v1/verifications Send

Params Authorization Headers (10) Body Pre-request Script Tests Settings Cookies

Headers 8 hidden

KEY	VALUE	DESCRIPTIO ...	Bulk Edit	Presets
Api-Key				
Content-Type	application/json			
Key	Value	Description		

POST https://faceai.gdcc.onde.go.th/api/v1/verifications Send

Params Authorization Headers (10) Body Pre-request Script Tests Settings Cookies

none form-data x-www-form-urlencoded raw binary GraphQL JSON Beautify

```
{
  "image_url1": "https://static.onecms.io/wp-content/uploads/sites/20/2020/12/02/taylor-swift1.jpg",
  "image_url2": "https://static.wikia.nocookie.net/taylor-swift/images/f/f8/
    966B835D-05BE-41A0-88E6-2F201B8E2A88.jpeg"
}
```

Viewer Text

- JSON
  - status : "done"
  - image_url1 : "https://static.onecms.io/wp-content/uploads/sites/20/2020/12/02/taylor-swift1.jpg"
  - image_url2 : "https://static.wikia.nocookie.net/taylor-swift/images/f/f8/966B835D-05BE-41A0-88E6-2F201B8E2A88.jpeg"
  - error_message : null
  - request_useragent : "PostmanRuntime/7.26.10"
  - requested_at : "2021-04-08T20:14:16.463259"
  - finished_at : "2021-04-08T20:14:18.484513"
  - results
    - similarity : 0.7400144338607788
    - match_level_1 : true
    - match_level_2 : true
    - match_level_3 : true
    - match_level_4 : true

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Contact for API Request on GDCC

- ✓ **Website:** https://gdcc.onde.go.th
- ✓ **GDCC Contact:** 02-024-1999 & Press 0
- ✓ **Email:** helpdesk@gdcc.onde.go.th

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