

Grassroots Startup Project Sharing

# Deep Learning Computer Vision 3D Sensor Algorithm Acceleration On FPGA Tutorial

## 2 – SGM cost function Color constrain

By GimHo.Ng/ 伍金和 (荷)

2023.3.29

G.E.M 鄧紫棋歌中的祕密 / the secret in GEM's music

【2507抬上帝入天坑】 / 【2507 carrying God back to heaven shit hole】 : <https://github.com/brianwchh/2507>

Tutorial files: <https://github.com/brianwchh/grassrootsstartup-ComputerVSION-zynq>

却江白春煙又  
爲山髮雨寒是  
紅不滄細依一  
顏因滄細舊年  
作百愁飄鎖櫻  
多花滿萬孤花  
情嬌枝家城季

二零二三年三月二十三日作

只人多江兩一  
因間情山鬟夜始  
多卻花白春  
懂嬌只草霜風  
女情爲本幾花  
人如紅無時滿  
花畫顏情來枝

女人花

[https://github.com/brianwchh/worldofheart\\_v2/blob/main/md\\_and\\_html/附庸風雅/女人花.md](https://github.com/brianwchh/worldofheart_v2/blob/main/md_and_html/附庸風雅/女人花.md)

# SOS Art Performance from chained talent girls

才女們無助的求救藝術行爲（含已自殺女星）노리개：그녀의 눈물

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

Top Chinese pop star



G.E.M 鄧紫棋  
wearing iron chain

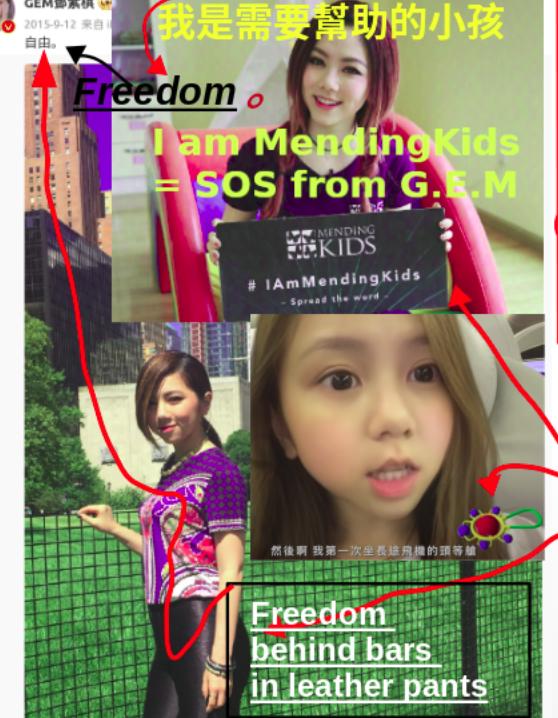
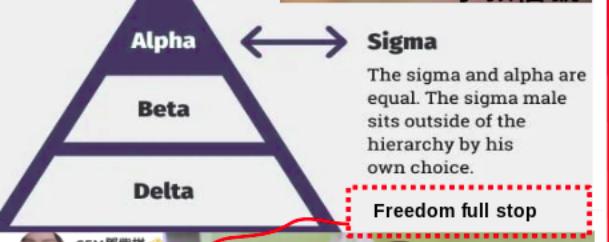


Ariel Tsai 蔡佩軒  
wearing iron chain



For more details please visit here: <https://github.com/brianwchh/SOSfromGEM>

South Korea pop star 설리 Choi Jinli's SOS signal to the public before hanging herself at home in 2019



가수 singer G.E.M

4471

8253

11.2万

# 玩物 노리개 의 눈물: 自由是鐵欄後皮褲的笑話

Freedom is a joke of leather pants behind bars



SOS art performance  
from chained talent girls



無形鐵鍊女們的  
求救禪語信息

## 解說鄧紫棋的祕密

「2507」 carrying God back to the heaven shit hole

# 「2507」抬上帝入天坑

小說解讀

Connecting dots to get the picture of the pyramid intelligence

## 連點成面之情報信息解析

Reveal the deep lies, traps & pitfalls

## 揭露深層的謊言、詭祕與圈套

Evil  
Project sigma !



歌手 가수蔡佩軒  
Ariel tsai, singer

SOS

Wake up all

小說地址: <https://github.com/brianwchh/2507>

解說影片: <https://youtube.com/playlist?list=PL4mHdDqV3T2uDeFnSC1bWhz3cN3wPZMzr>

Message from  
US-China  
balloon incident

Virus Unrestricted War !

深層政府十字軍東征中國之 sos

中美氣象氣球事件  
“非當年 UFO 事件”

Roswell Balloon  
Bubble

Lies 泡沫  
病毐 超限戰  
The Cross Bubble  
十字架 = 10 = 黑1

# The tutorial plan

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

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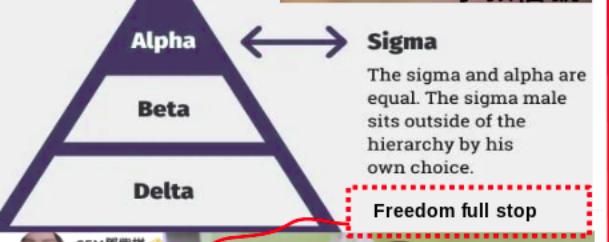
- Let's read the papers together
- Design algorithm on computer using C++
- System diagram design
- Write Verilogc code for each module & simulation
- ~~FPGA on board debugging (zyng 7020)~~
- ~~Embedded linux os bringing up~~
- Writing linux device driver
- Design application APPs on arm and linux computer for demos

# Agenda of this episode

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

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- › Explain the cost function's color constrain term
  - (1) Disparity
  - (2) Census transform
  - (3) Matching cost function ( the color constrain term )



가수 singer G.E.M

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玩物 노리개 의 눈물: 自由是鐵欄後皮褲的笑話  
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SOS art performance  
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The secret behind singer G.E.M's music

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病毐 超限戰  
The Cross Bubble  
十字架 = 10 = 黑1

# Who triggered this bomb

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)



「노리개 : 그녀의 눈물」 a movie based on her tragedy , 漢語「玩物」 2013



張紫妍 장자연 「性朝貢」事件：童話故事下的殘酷人生  
2009 年自殺身亡的南韓女星張紫妍

장자연 (Jang Ja-yeon) sexual bribery puppet actress in south Korea, committed suicide by hanging herself at home in 2009, only left behind her diary detailing every man she had to sleep with, sometimes multiple men at a time !  
"They" really don't care about us!  
"They" are still at large!  
"they" have the power and resource to be not just on top of your woman, but also you, at will !  
You don't believe?! I understand! That is because you know nothing about "them", the mysterious deep state! just like me used to be!  
You still believe, like a book nerd, that law can protect you? Not in front them, who are good at setting up sweet pitfalls, and make you a chained puppet! And hard to get away nor prove your situation!  
You don't know their secret weapons, just like we don't know UFO and where human come from? Do you know? Or you don't care?! Still think these are far away from you ?!

## Korea is only a screen shot of the world !

Worldwidely, numbers of chained girls are in the same situation where they are **sexually abused**, but having difficulties to prove.

# The dirty training data for ChatGPT

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

The “God” selected people owns technology from the weather balloon in Roswell in 1947 !

## chatGPT 邪惡的數據採集與人類的未來

Neuralink's monkey playing mind-controlled video game, eating banana and sucking banana juice as a reward.

沒有一家公司可以重現微軟的chatGPT，除非你是“神”選之“民”才能有氣象氣球的技術。技術有多驚豔，數據來源就有多醜惡！因為你不瞭解腦控！問問下面這隻猴子？



馬斯克的猴子正在推動一場腦機革命，代價只是“香蕉奶昔”\_創世記\_新浪科技\_新浪網

我們被當着是活體實驗卻很難證明



鄧紫棋歌曲「超能力」，特工鄧紫棋的讀腦超能力，與外星人

像不像CIA的測謊原理，心電圖只是個障眼法？

Agent GEM's music : Superpower , the alien's mind-control technology ! Seems like coincidence and joking. Just like her freedom behind bars in leather pants.

你們應該知道的難得一見的妃子笑，不是荔枝，而是歌手蔡佩軒沒有眼淚的陶醉。美人一笑，連chatGPT都會寫歌譜曲了。

# Who controls GEMs

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)



G.E.M.鄧紫棋【句號 Full Stop】Official Music Video

2.67M subscribers

47,606,570 views Premiered Nov 22, 2019 #鄧紫棋 #GEM #句號  
Stream/Download the song here: <https://gem.link.to/FullStop>

我青春的全部回憶  
那要的恨的全都是你  
可惜我們終於來到一個句號

Man with cross in black gentlemen hat and suit



G.E.M.鄧紫棋【句號 Full Stop】Official Music Video

2.67M subscribers

47M views 3 years ago #鄧紫棋 #GEM #句號  
Stream/Download the song here: <https://gem.link.to/FullStop>

Puppet magic box



G.E.M.鄧紫棋【句號 Full Stop】Official Music Video

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我青春的全部回憶  
那要的恨的全都是你  
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Controlling the puppet



Deep state



What is Project sigma?

In her song [full stop/ 句號 ], she implies herself as a puppet controlled by the cross! The box of needle looks like a magic box !

So the MV tells a different story rather than that she promoted publicly which is the dispute between her and her former company,i.e. hummingbird music.

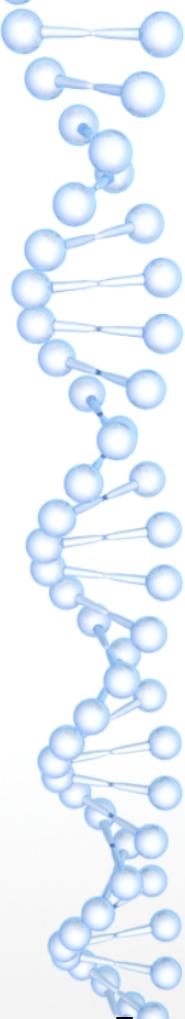
This unsaid story matches other stories embedded in her other songs, such as [bubble], i.e. bible= bubble= lies! And [fearless/ 毒蘋果 ] which is about the sweet lies and attemptation in the “bible” book!

She is a christian at very young, she went to christian school since very young! So the age matches the little girl in the MV, who came across this magically mysterious gentleman in black suit & hat at very young age .

The real world is highly possibly different from what we have seen and been taught! There is a reason that we don't know where we are from and who we really are! Because “they” don't want us to know! We are trapped in this world's physics / phenomenaons, which only UFO have the authority to overwrite.

# More ugly secrets in GEM's music

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)



Joe Biden  
他們即牠們，即深層政府，即傀儡拜登所說的 *they, they gave me reporter list ...*

鄧紫棋，凳子妻（伍大 / 金 ❤ 與鄧金蓮 / Queen of heart）前世今生的蘋果

For more please read novel 【2507 拝上帝入天坑】：<https://github.com/brianwchh/2507>  
【2507 carrying God back to heaven shit hole】

More about the dark deep state

接下來幾頁是暗線之極惡暗黑深層政府

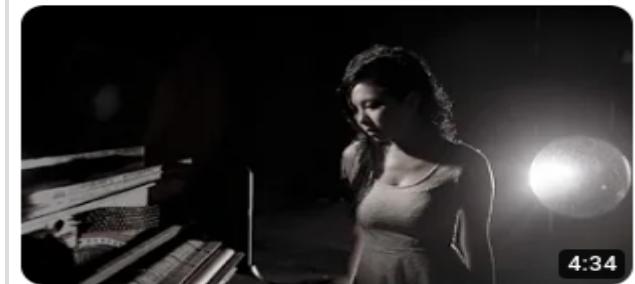
bubble = bible = +  
=poisonous apple  
=lies

+

喂，凳子，誰想嫁給你啊  
誰要認識你啊  
是牠們逼我的



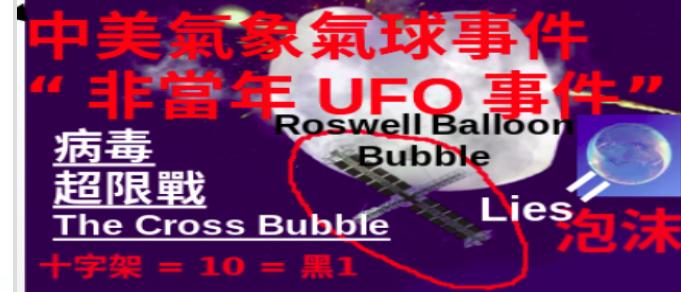
15



G.E.M. "泡沫" "BUBBLE" [HD] 官方MV 鄧紫棋  
17M views • 10 years ago

Virus Unrestricted War !

深層政府十字軍東征中國之 sos



G.E.M. 【毒蘋果 FEARLESS】 Official Audio [HD] 鄧紫棋  
2.4M views • 4 years ago

Poisonous apple

Message taken from China-US weather balloon incident : Black cross army heading its way east to China ! It is not to remind you the fake weather balloon in roswell 1947

# Why I am doing this tutorial

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

- Sharing every details of my startup project , i.e. 3D sensor, including source code , simulation and debugging skills of FPGA.
- During break time, tell you the ugly secrets in G.E.M's music. Please believe me, this is far more important than the valuable project I am sharing here. When you read this far you might already know that accelerating algorithms on FPGA is very important ,and difficult as well ! **But this information in GEM's music is far more important and far more difficult to speak out !** Some Korean pop stars have already "committed suicide" trying to prove the real truth!
- My life is in a mess when I was selected by them to be involved with the dirty and disgusting secret project, of course, without my permission and without letting me know, together with a lot of chained talent women and men. **We are being treated as experimental monkeys !** And the result will come and apply to you and your next generation eventually! You have no choice to be audience! Did you embrace chatGPT and boston dynamics robots yet ?! Did you ask yourself who is chatGPT's teachers ? Where did the private and dirty training data come from ? Can you write songs ? Probably no! But chatGPT can, amazing, isn't it !?



Neuralink's monkey playing mind-controlled video game, eating banana and sucking banana juice as a reward.



Agent GEM's music : Superpower , the alien's mind-control technology ! Seems like coincidence and joking. Just like her freedom behind bars in leather pants.



# The cost function

[https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

- SGM method (Hirschmüller, 2008)
  - it aims to minimize the global cost function

$$E = \sum_p (C(p, D_p) + \sum_{q \in N_p} P_1 T[|D_p - D_q| = 1] + \sum_{q \in N_p} P_2 T[|D_p - D_q| > 1])$$

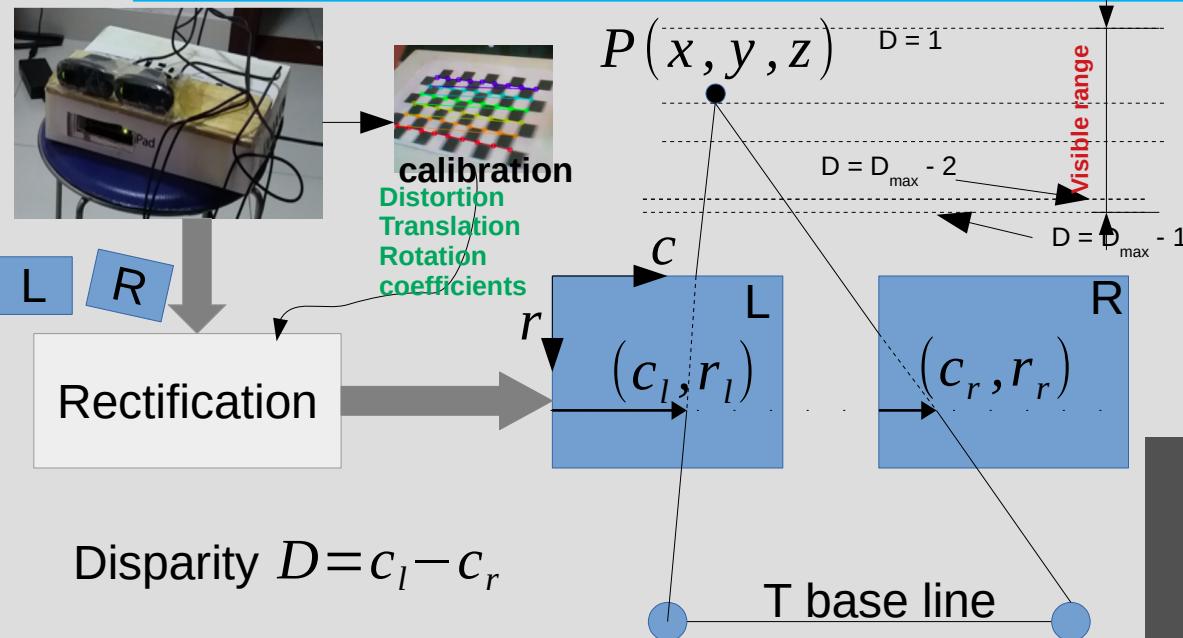

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color constrain term	spacial constrain term
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- We are going to explain this
  - Before that let's review some concepts that we need to understand this function
    - Disparity
    - Census transform
    - Matching cost function

# Disparity

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)



Examples of disparity map



- Assume you know rectification theory, you can find it in many textbook.
- I convert the source code of rectification from openCV source code to verilog HDL.
- Better use ARM or its hardcore IP to do the job, FPGA block ram is too expensive to deal with large distortion.

# From Disparity to 3D coordinates

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

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- › We know  $D(r,c)$  at image location  $(r,c)$  in pixels
- › Then We know the 3D location  $(x,y,z)$  of the object in 3D space

$$\text{distance } z = \frac{f * T}{D} \quad f \text{ is focal length}$$

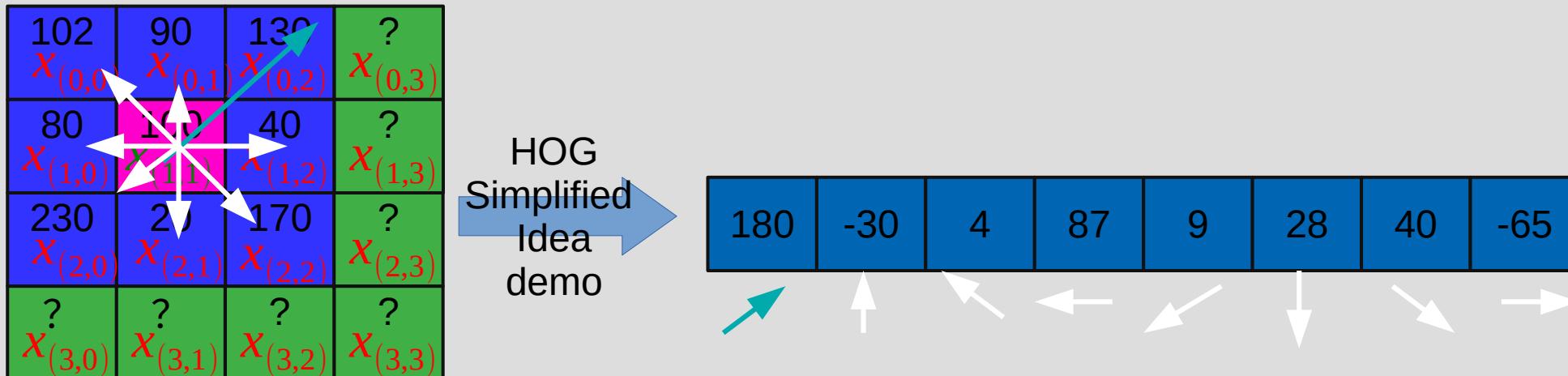
The key problem here is : **finding the corresponding points  $X_l$  in left and  $X_r$  right image.**

To make things to get start easily I just illustrate how to get z coordinate from disparity value, later in this course I will show you how to get x and y value from disparity and its image coordinate r and c,ie. row and column value.

# Methods to find corresponding points

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

- Barely impossible directly using pixel value RGB or grayscale value. **Stand alone color information!** (fatal : lleft & right CMOS exposure condition hardly be the same! So pixel value can hardly be the same!)
- HOG(histogram of gradients) kind of feature method is too complicated in computation. Feature = color (changing) relationship with neighboring pixels!
  - ➔ Pros: exposure won't affect color gradient, shit & rotation & scale invariant !
  - ➔ Cons: computationally extensive! **Solution :** using census transform feature!



# Census transform

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

102 $X_{(0,0)}$	90 $X_{(0,1)}$	130 $X_{(0,2)}$	?
80 $X_{(1,0)}$	100 $X_{(1,1)}$	40 $X_{(1,2)}$	?
230 $X_{(2,0)}$	20 $X_{(2,1)}$	170 $X_{(2,2)}$	?
?	?	?	?

3 x 3 transform kernel

1 $X_{(0,0)}$	0 $X_{(0,1)}$	1 $X_{(0,2)}$
0 $X_{(1,0)}$	P $X_{(1,1)}$	0 $X_{(1,2)}$
1 $X_{(2,0)}$	0 $X_{(2,1)}$	1 $X_{(2,2)}$

Stretch to make a 1 dimensional vector to replace pixel value, ie, 100.

1	0	1	0	0	1	0	1
---	---	---	---	---	---	---	---

$X_{(0,0)} \ X_{(0,1)} \ X_{(0,2)} \ X_{(1,0)} \ X_{(1,2)} \ X_{(2,0)} \ X_{(2,1)} \ X_{(2,2)}$

How to get pixel P, ie  $X_{(1,1)}$ 's census transform value ?

Encoding surrounding pixels' color information as the current pixels' feature vector. ie. binary pattern feature.

As shown in the left, if greater than central pixel p, then use 1 to denote that, otherwise 0.

The census transform output of pixel P  $X_{(1,1)}$

Follow the same procedure we can get all the other pixels' census transform output value.

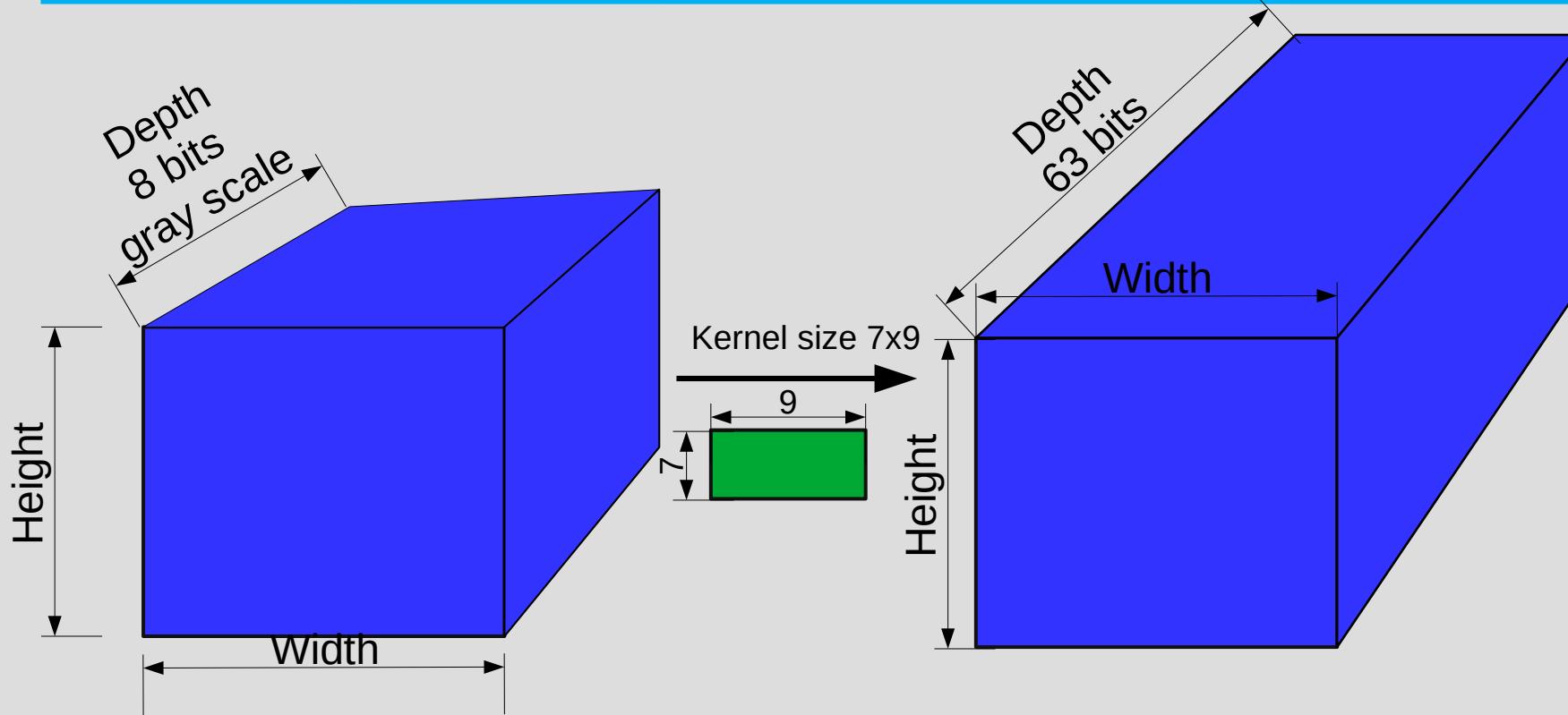
Keep in mind the memory layout.

Before : 8bits gray scale value

After :  $3 \times 3 - 1 = 8$  bits, this varies with kernel size

# The memory layout of Census transform output

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)



Keep in mind the memory layout is very important for understanding the algorithm and its implementation in both CPU/GPU/ARM or FPGA .  
理解內存分佈對理解算法及其 CPU/GPU 或 FPGA 硬件實現非常重要。

For a 9x9 kernel size census transform, each 8bits original image pixel value is replaced with  $7 \times 9 - 1 = 63$  bits texture value, which represent its color texture relationship with its neighboring pixels. 由 8bit 像素值變成  $7 \times 9 - 1 = 63$  bits 的紋理數值，即其比相鄰像素值大或小謂之紋理特徵。

# Matching cost function

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

$$E = \sum_p \underline{C(p, D_p)} + \sum_{q \in N_p} P_1 T[|D_p - D_q| = 1] + \sum_{q \in N_p} P_2 T[|D_p - D_q| > 1]$$



$$E = \sum_p C(p, D_p)$$

Matching cost function's color constrain term

# Matching cost function

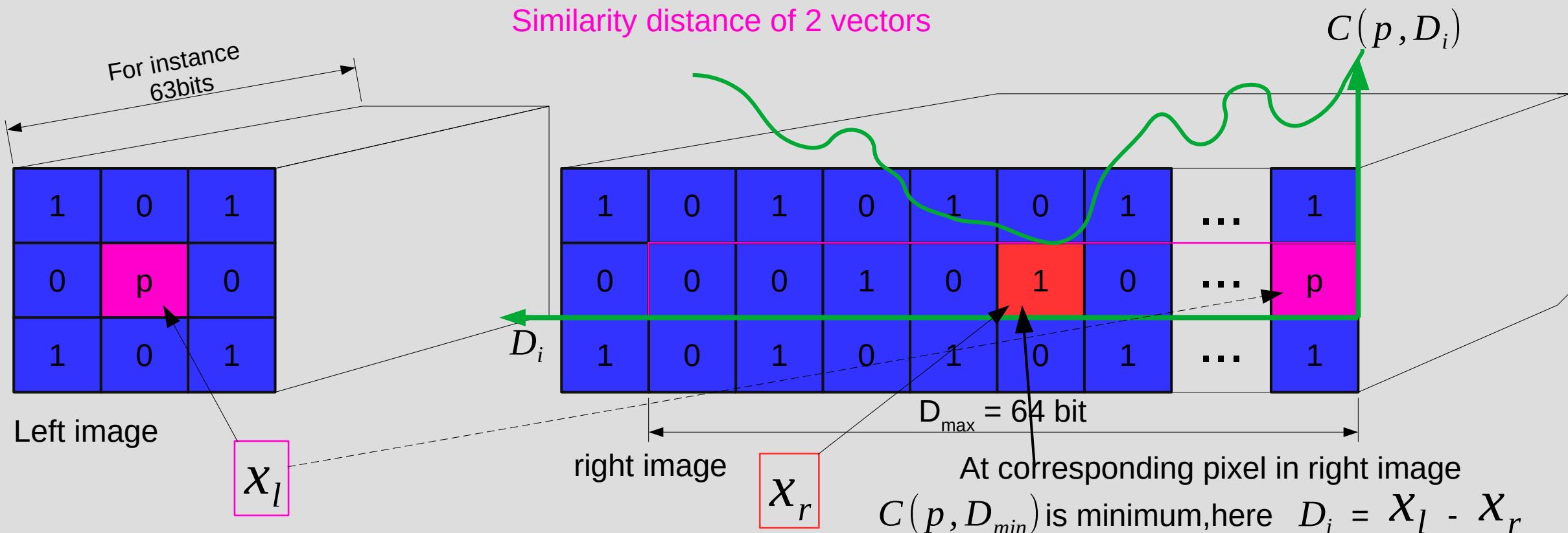
#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

$$E = \sum_p C(p, D_i)$$

Matching cost term, when each pixel reaches minimum, global sum is minimum.

$$C(p, D_i) = \text{number of ones } (\underline{C_{img_l}(p) \text{ XOR } C_{img_r}(p - D_i)})$$

Similarity distance of 2 vectors



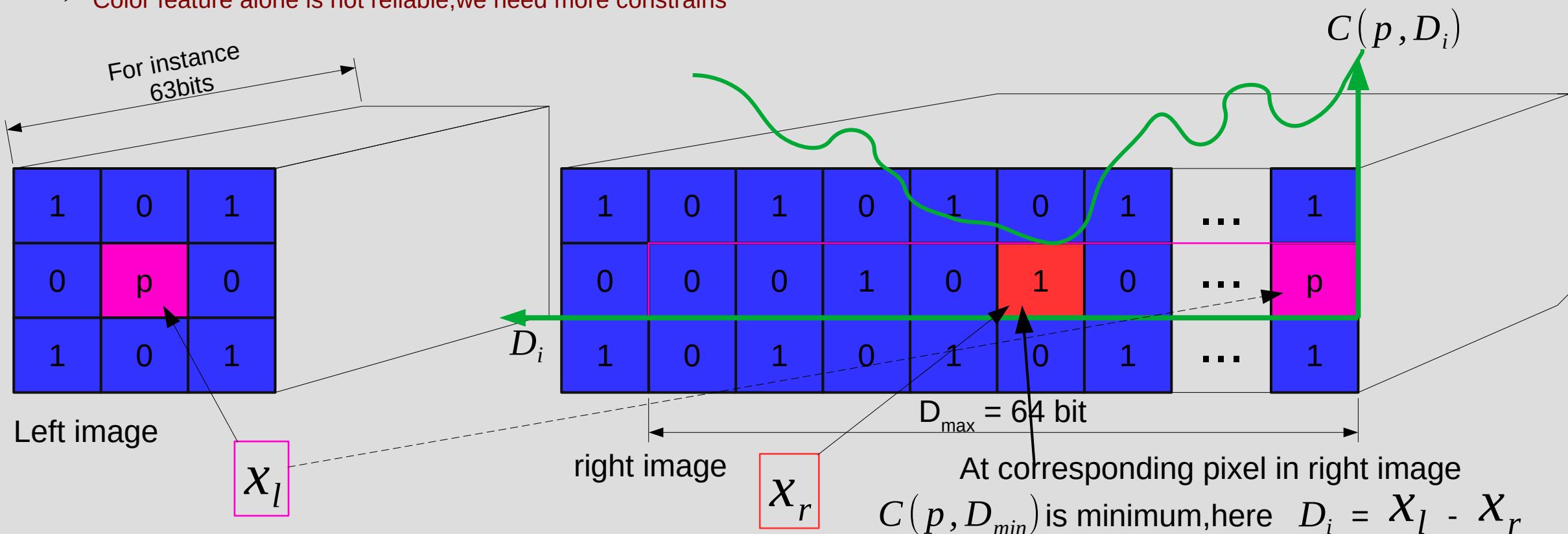
# Matching cost function, Cons

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

$$E = \sum_p C(p, D_i) \quad C(p, D_i) = \text{number of ones } (\underline{C_{img_l}(p)} \text{ XOR } \underline{C_{img_r}(p-D_i)})$$

Similarity distance of 2 vectors

- Using Matching cost function's color constrain term based on the census transform feature map alone is possible to find the corresponding pixel in the right image, then get the disparity value.
- The drawback is too many mismatching could happen, due to repeated color pattern
- Color feature alone is not reliable, we need more constraints



# Next: adding spacial constrain term

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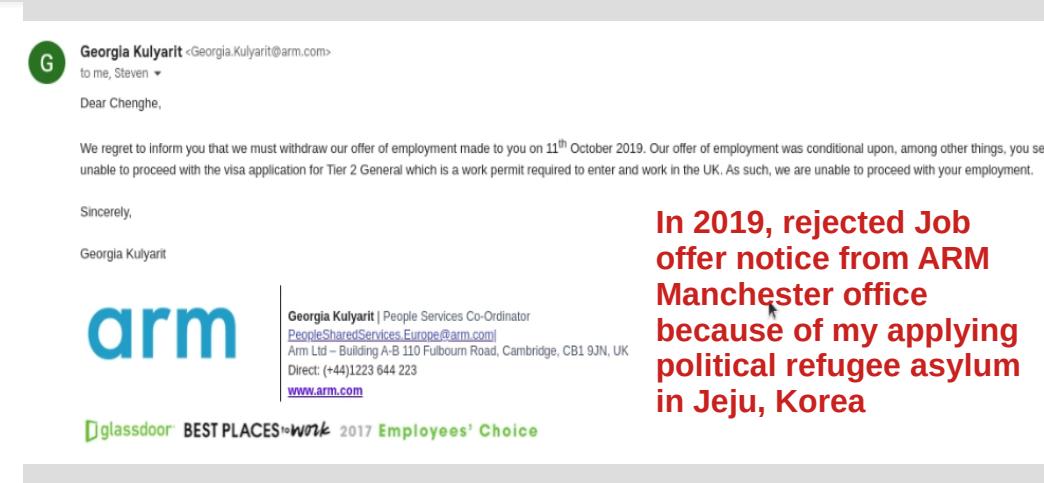
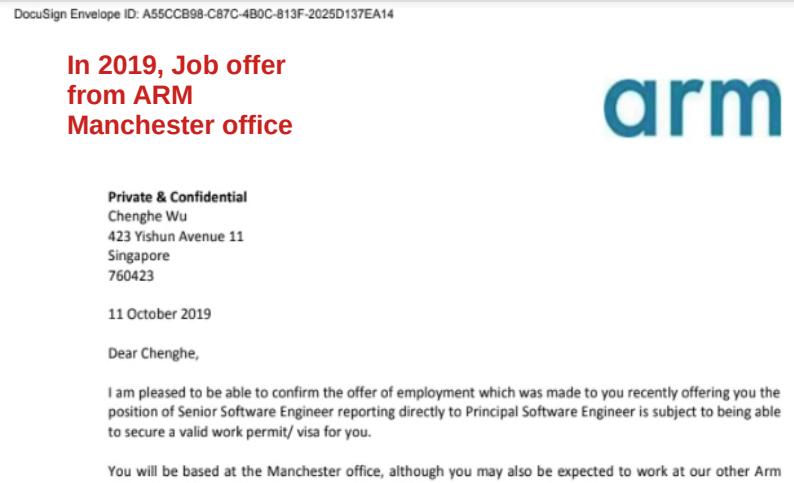
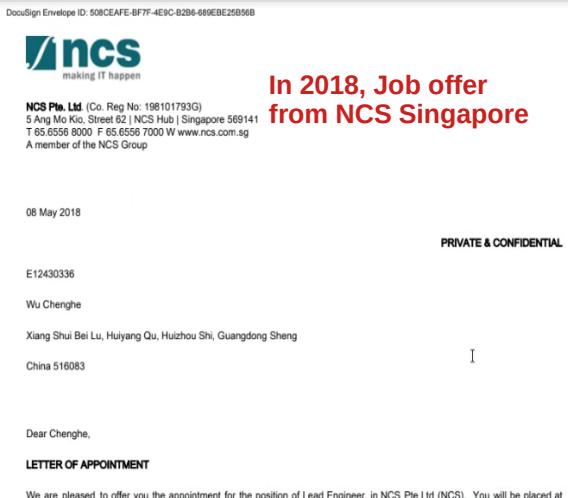
$$E = \sum_p (C(p, D_p) + \underbrace{\sum_{q \in N_p} P_1 T[|D_p - D_q| = 1] + \sum_{q \in N_p} P_2 T[|D_p - D_q| > 1]}_{\text{spatial constraint term}})$$

# Brief intro. about me

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)

- Over 11+ years of R&D work experience, capable of designing and deploying computer vision and deep learning algorithms on embedded device like FPGA and ARM.
- Full stack web development with Django, React/Vue/Nextjs, MySQL, Nodejs, Golang, etc....
- skilled at FPGA / ZYNQ SOC design ( Verilog HDL )
- good at GPU ( CUDA + openGL )
- Good at programming languages: C/C++, python, javascript, Golang, verilog HDL
- Familiar with Deep learning libraries like Tensorflow, Darknet...
- rich work experience in : SLAM / Visual SLAM, ROS, VR, AR, 3D sensing (Stereo vision), object detection, motor control

More on LinkedIn : <https://www.linkedin.com/in/brianwchh/>



G.E.M. 【幫你實現新年願望】 鄧紫棋  
52K views • 5 years ago

In 2018, GEM help you to fulfill the new year dreams

# Thank you

#hohy #metoo #MeTooMovement [https://github.com/brianwchh/ChatGPT\\_mindControl\\_dataset](https://github.com/brianwchh/ChatGPT_mindControl_dataset)



SOS art performance  
from chained talent girls



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小說地址: <https://github.com/brianwchh/2507>

← 解說影片: <https://youtube.com/playlist?list=PL4mHdDqV3T2uDeFnSC1bWhz3cN3wPZMzr>

**SOS**  
**Wake up all**

