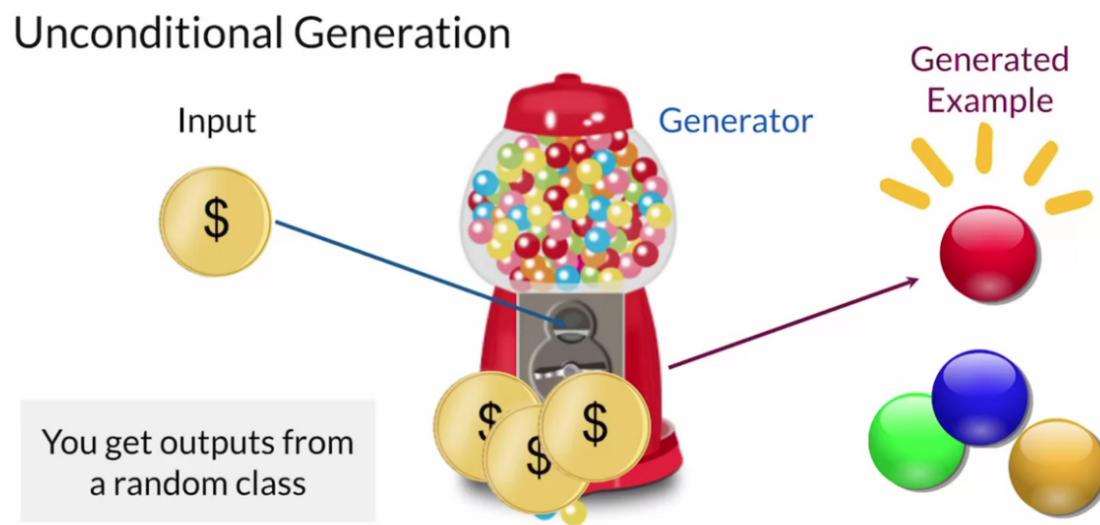


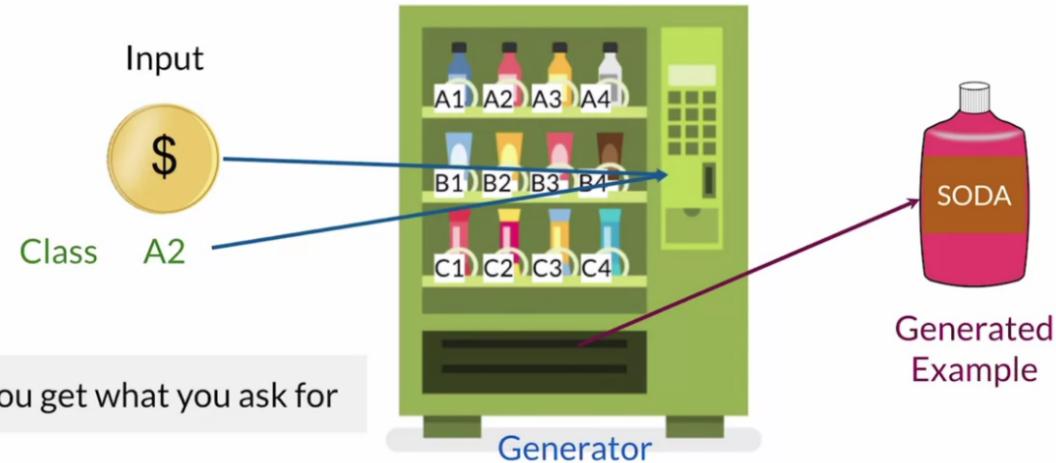
## Conditional GAN & Controllable Generation

- Unconditional generation
- conditional vs. unconditional generation

### Conditional generation: Intuition



## Conditional Generation



## Conditional vs. Unconditional Generation

Conditional	Unconditional
Examples from <b>the classes you want</b>	Examples from <b>random classes</b>
Training dataset needs to be <b>labeled</b>	Training dataset <b>doesn't need to be labeled</b>

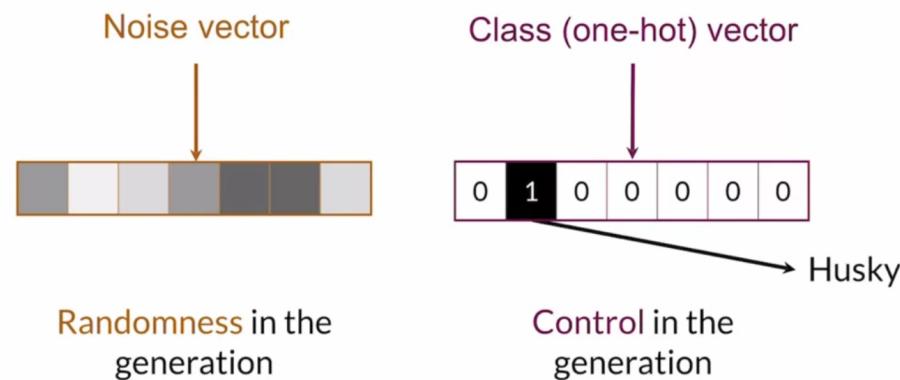
## 요약

- 조건 생성은 라벨있는 자료를 요구한다.
- 예제들은 선택된 클래스에 대하여 생성될 수 있다.

## 조건 생성 : 입력

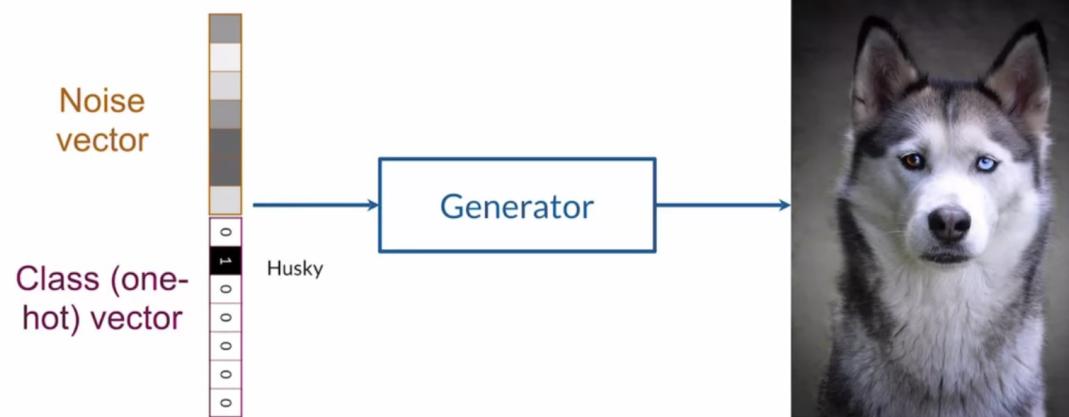
- 생성자에게 어떤 종류의 예를 생성하라고 어떻게 말할 수 있는가?
- 감별자의 입력 표현

### 생성자 입력



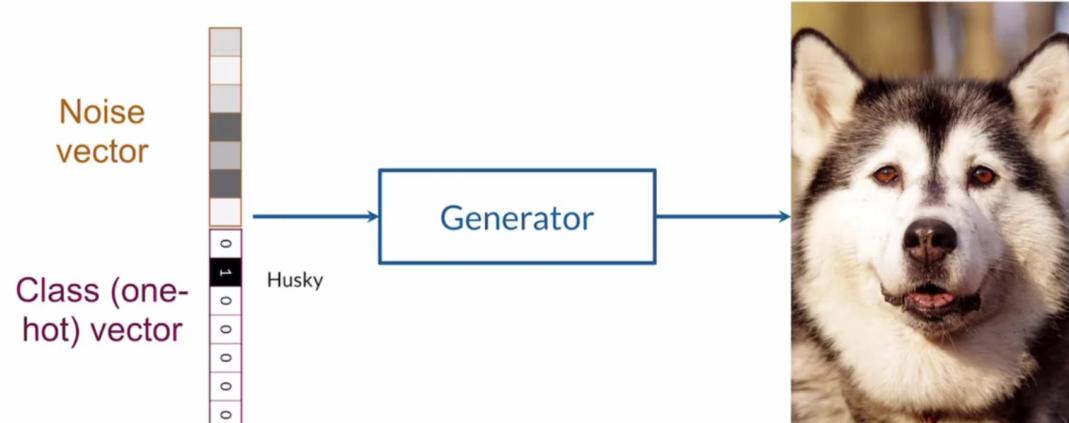
## Generator Input

## Output

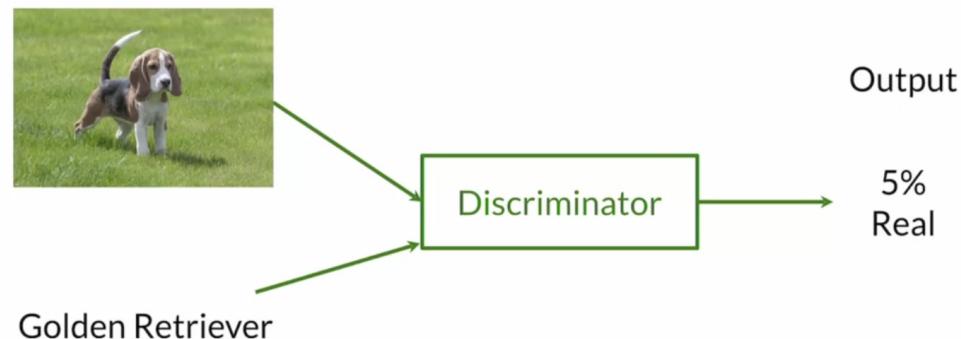


## Generator Input

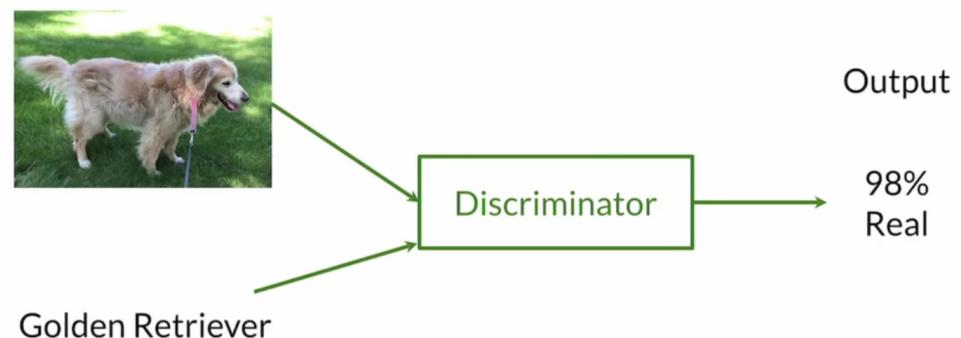
## Output



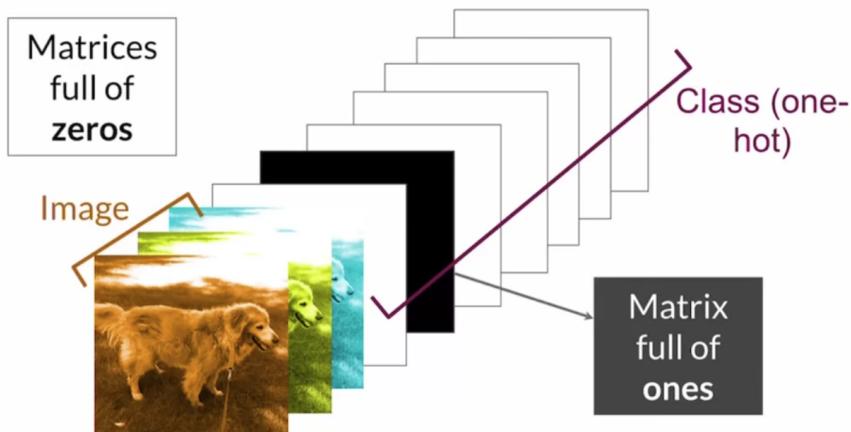
## Discriminator Input



## Discriminator Input



## Discriminator Input



## 요약

- 생성자에게 전달되는 클래스는 one-hot 벡터이다.
- 감별자에게 전달되는 클래스는 one-hot 행렬이다.
- 벡터의 크기와 행렬의 수는 클래스 개수를 나타낸다.

## 제어 가능한 생성기

- 제어 가능한 생성기란?
- 조건 생성자와의 비교 방법?

## Controllable Generation



Change specific features of the output

Available from: <https://arxiv.org/abs/1907.10786>

## Controllable Generation

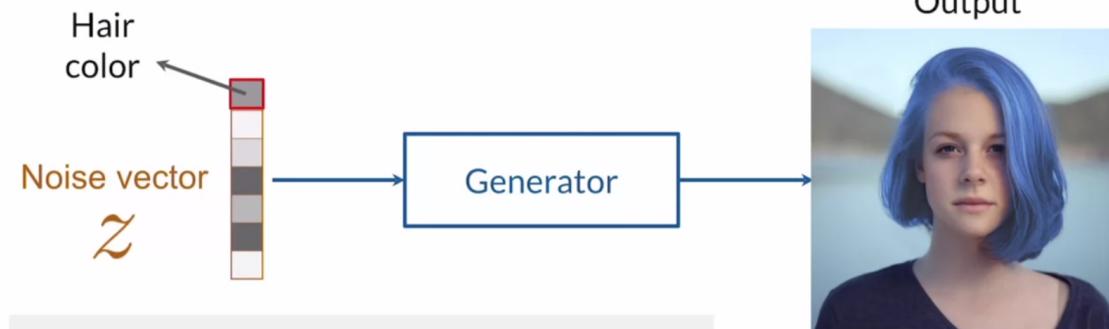
Controlled  
Output

Noise vector  
 $z$



Tweak the input noise vector to get different features on the output

## Controllable Generation



Tweak the input noise vector to get different features on the output

0:57

## Controllable Generation vs. Conditional Generation

Controllable	Conditional
Examples with the <b>features that you want</b>	Examples from <i>the classes you want</i>
Training dataset <b>doesn't need to be labeled</b>	Training dataset <i>needs to be labeled</i>
<b>Manipulate the <math>z</math> vector input</b>	<i>Append a class vector to the input</i>

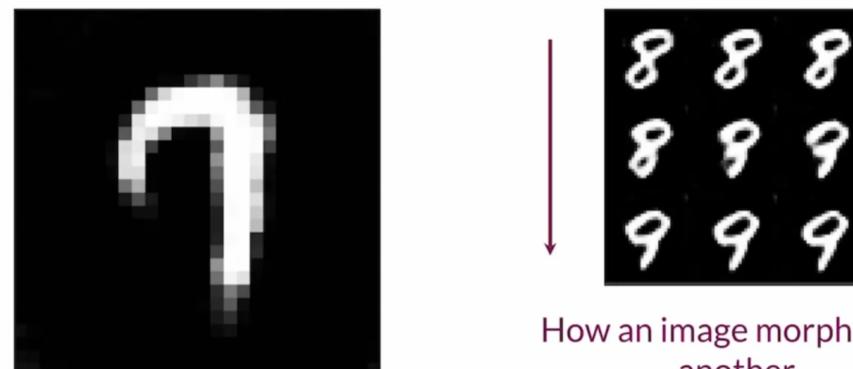
## 요약

- 제어 가능한 생성자는 생성된 출력의 특징을 제어할 수 있게 해준다
- 이는 라벨된 훈련자료를 요구하지 않는다.
- 다른 특징의 출력을 얻기위해서 입력 벡터를 조정한다.

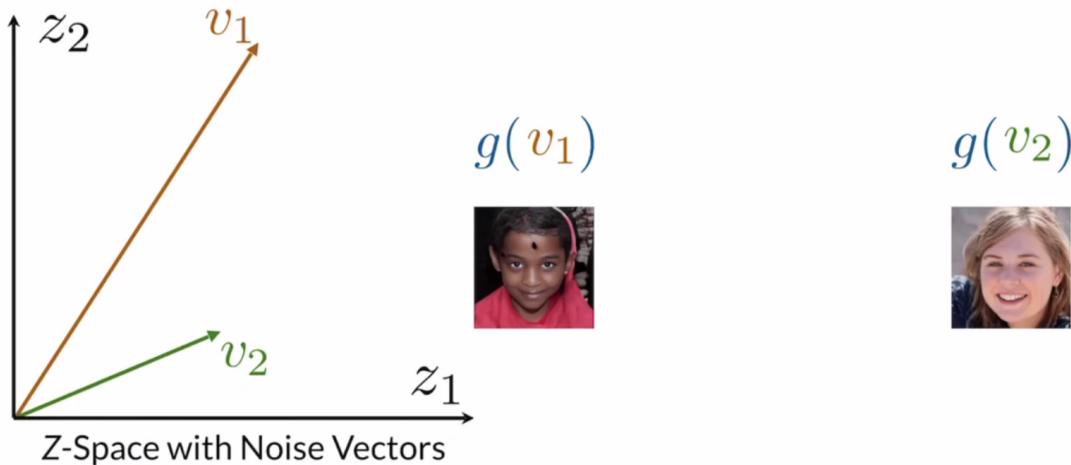
## Z-공간에서의 벡터 대수

- Z-공간에서의 내삽(interpolation)
- 원하는 특징의 조정을 위한 잡음벡터 z의 수정

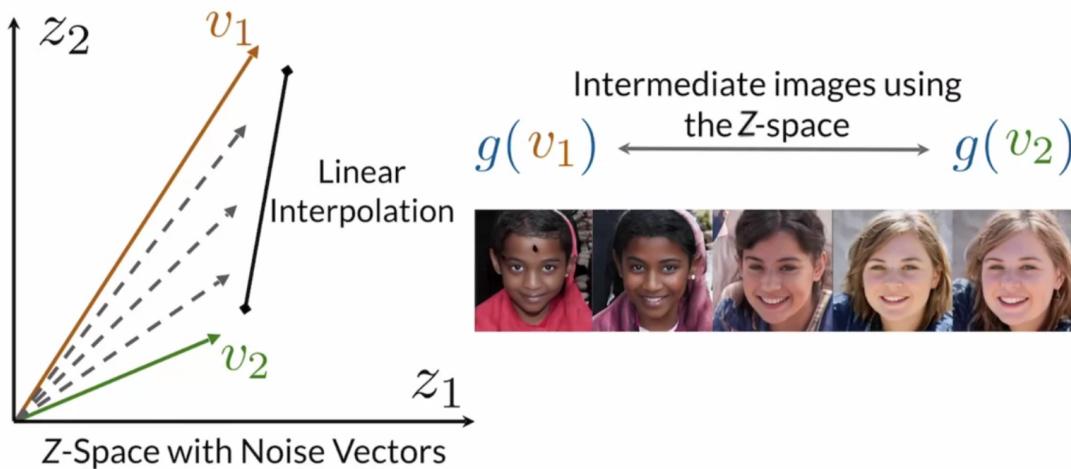
## Interpolation Using the Z-Space



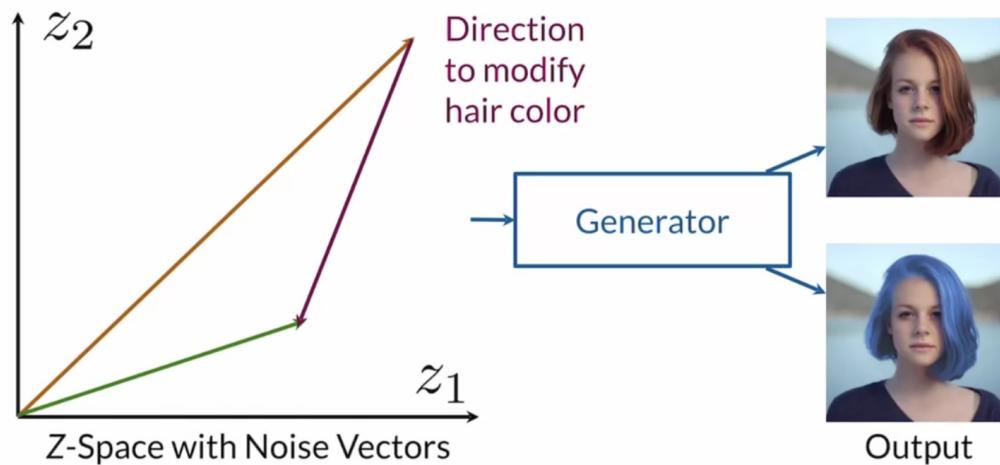
## Interpolation Using the Z-Space



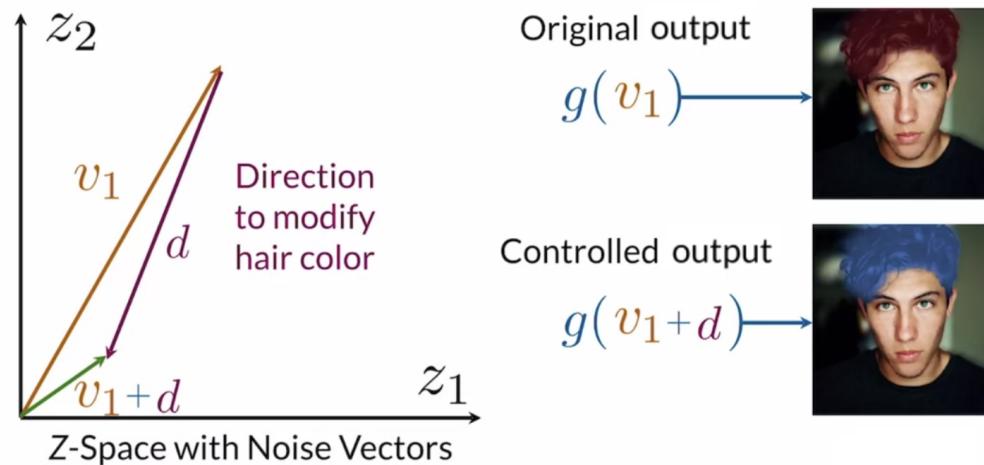
## Interpolation Using the Z-Space



## Z-Space and Controllable Generation



## Z-Space and Controllable Generation



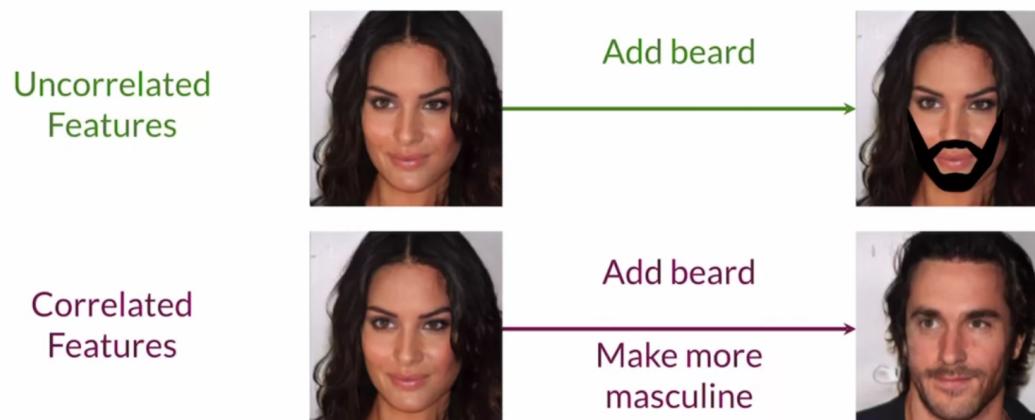
## 요약

- 출력 특징을 조정하기 위해서는 Z-공간에서의 방향을 찾을 필요가 있다.
- 출력을 변경하기 위해서는 Z-공간에서 이동해야 합니다.

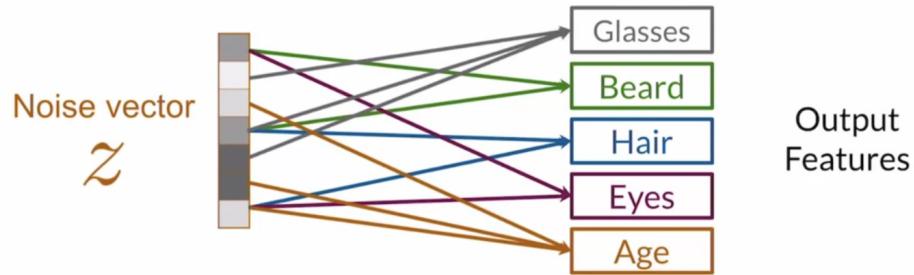
## 제어 가능한 생성자의 과제

- 출력 특징의 상관관계
- Z-공간의 얹힘(entanglement)

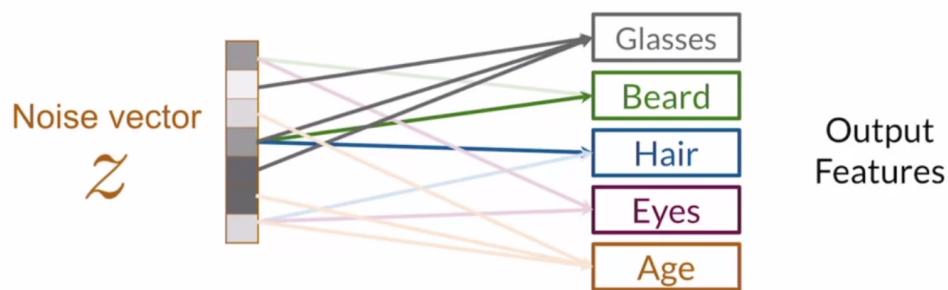
## Feature Correlation



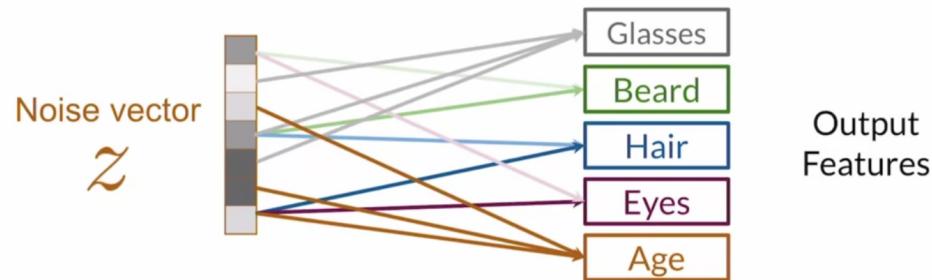
## Z-Space Entanglement



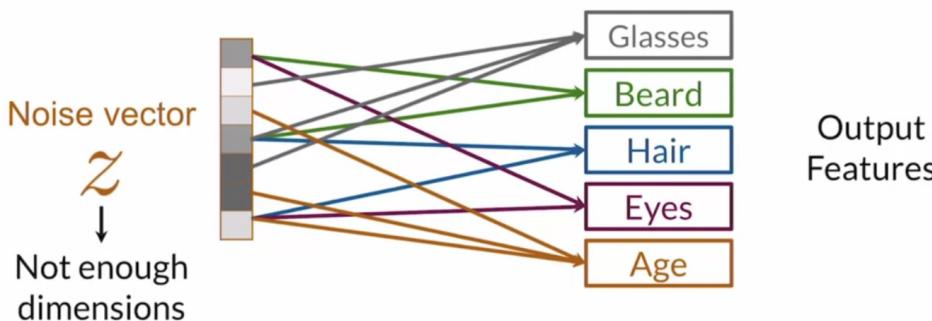
## Z-Space Entanglement



## Z-Space Entanglement



## Z-Space Entanglement



It is not possible to control single output features

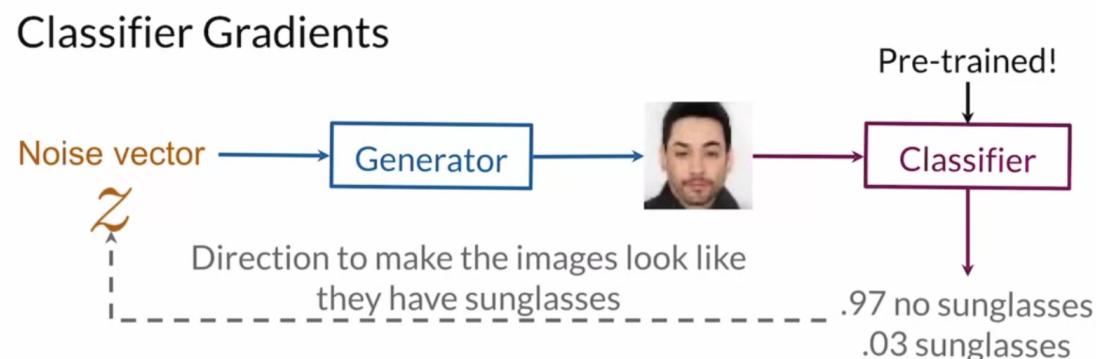
### 요약

- 하나의 특징을 조정하고자 한다면, 상관된 다른 것들도 변화한다.

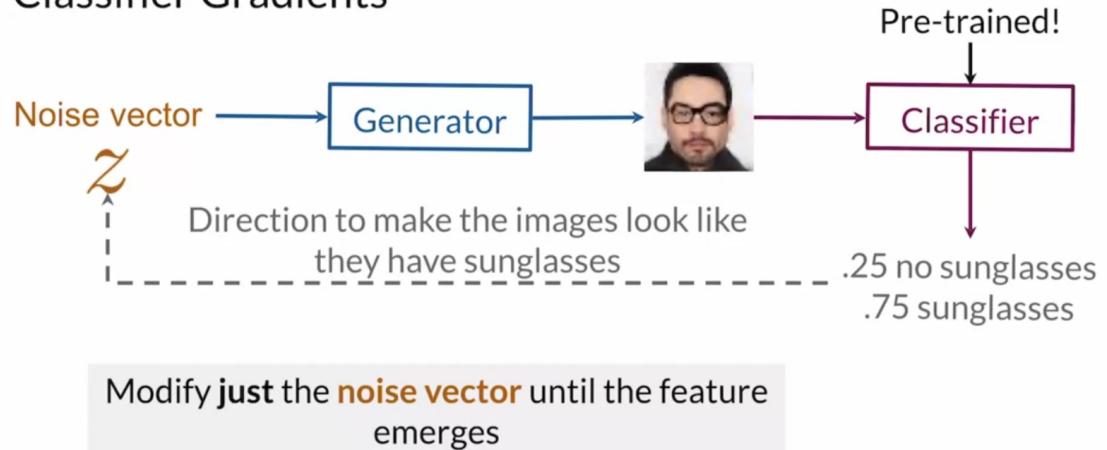
- Z-공간 얹힘이 제어를, 불가능하지 않다면, 어렵게 한다.
- 얹힘은 z-공간의 차원이 충분하지 않을 때 발생한다.

## 분류기 그레이디언트

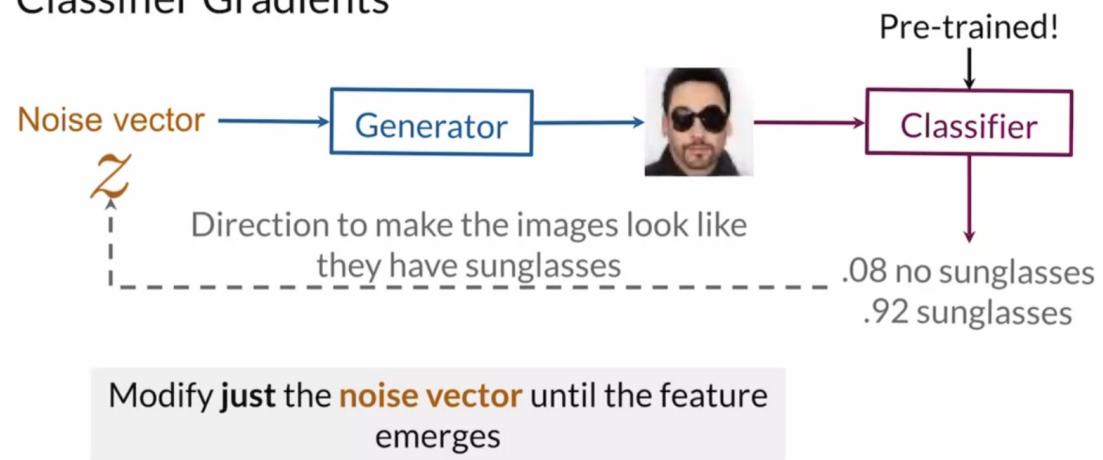
- Z-공간에서 방향을 찾기 위해 분류기를 어떻게 사용하는가?
- 이 방법을 사용하는데 있어서 요구조건



## Classifier Gradients



## Classifier Gradients



## 요약

- 분류기가 Z-공간에서의 방향을 찾는데 사용될 수 있다.
- 방향을 찾기위해서, 단지 잡음 벡터에만 개선하면 된다.

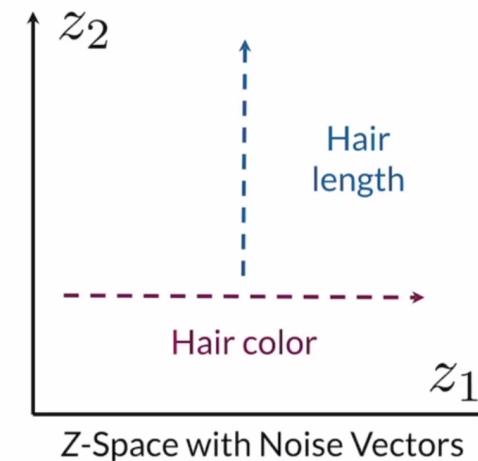
## 얽힘 해제(disentanglement)

- 얹힘 해제 Z-공간은 무엇을 의미하는가?
- 얹힘 해제 Z-공간을 장려하는 방법들

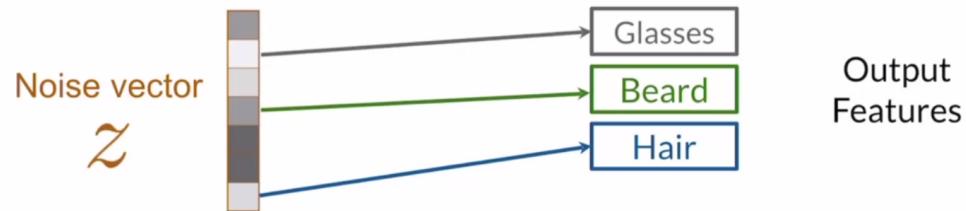
Disentangled Z-Space

	$z_1$	$z_2$
$v_1 = [$	1,	2, 3, ... ]
$v_2 = [$	5,	6, 7, ... ]
Hair color		Hair length

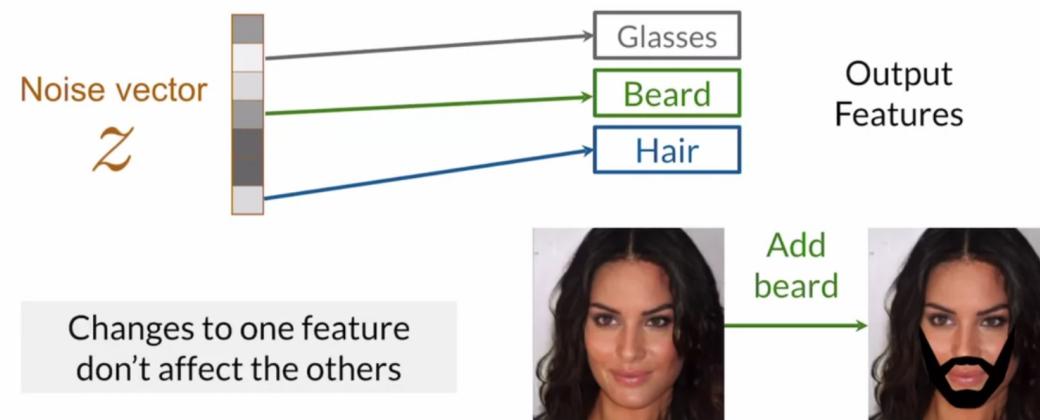
Latent factors of variation



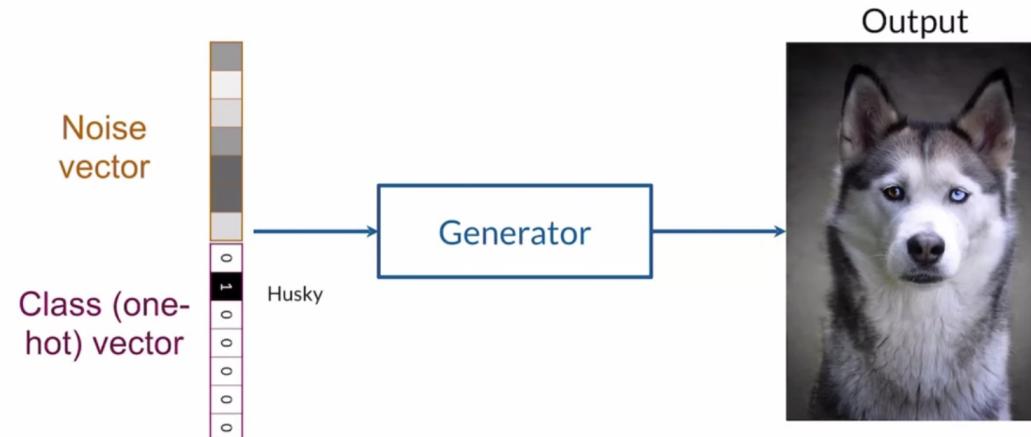
## Disentangled Z-Space



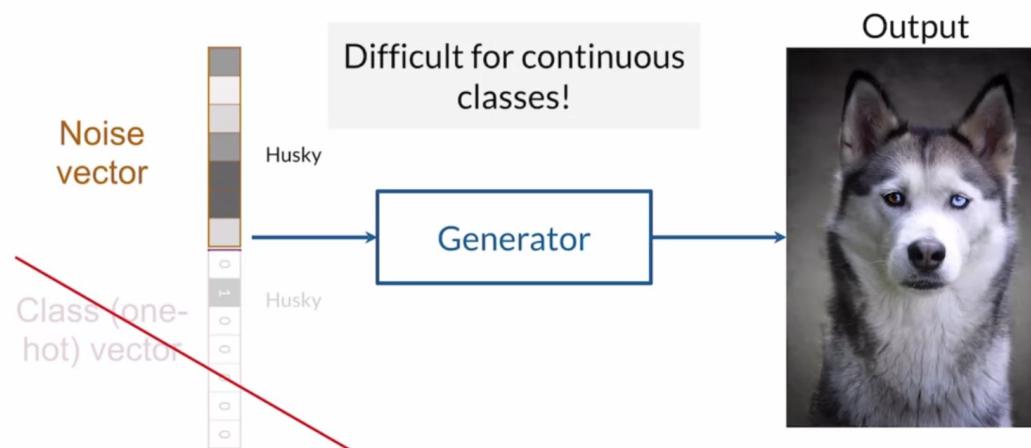
## Disentangled Z-Space



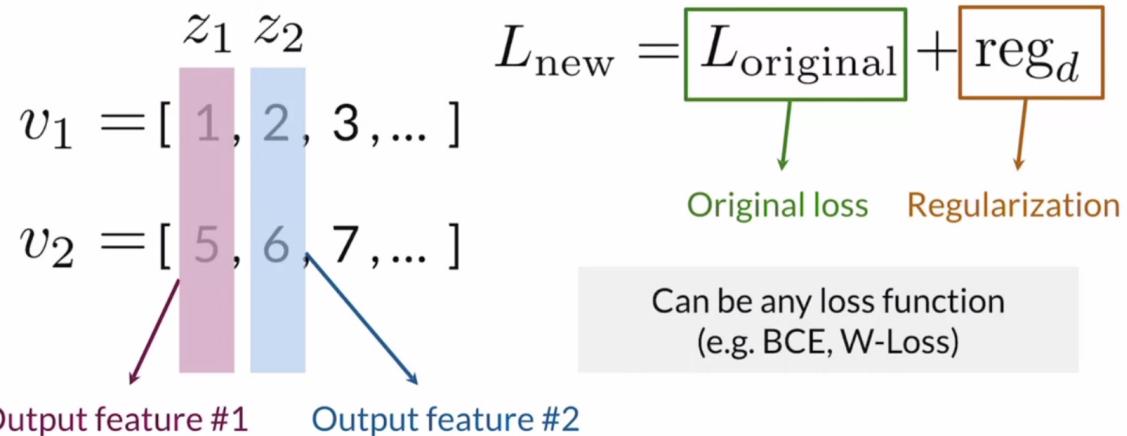
## Encourage Disentanglement: Supervision



## Encourage Disentanglement: Supervision



## Encourage Disentanglement: Loss Function



### 요약

- 얽힘 해제 Z-공간은 각각의 특징들에 해당하는 z-값을 직접 조정할 수 있게 해준다.
- 얽힘 해제를 이루기 위해서는 지도 및 비지도 방법이 있다.

In [ ]:

In [ ]: