

Learning from synthetic data - Generation for learning – Hands on

The INvicta school of Vision, Computational intelligence, and patTern Analysis -
INVICTA

Naser Damer

The content of this talk is largely based on works lead by:

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Why data?

What do we NEED to develop a rational agent?

1. Data that the agent expect to see in operation
2. The agent architecture (linear equation, or 1B parameter NN)
3. Targeted setting of parameters (a and b), i.e. loss
4. In many cases, but not necessary, labels for the data to help the loss

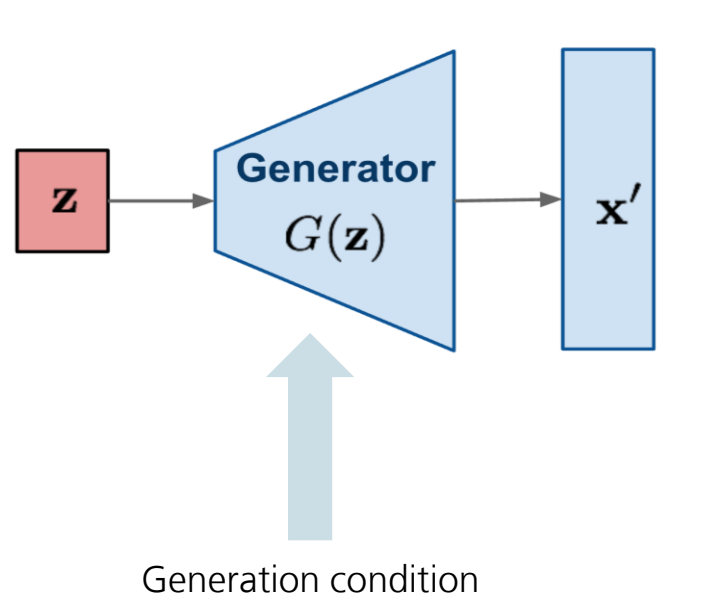


Goal

Create a synthetic data with 3 classes and train a classifier on this data

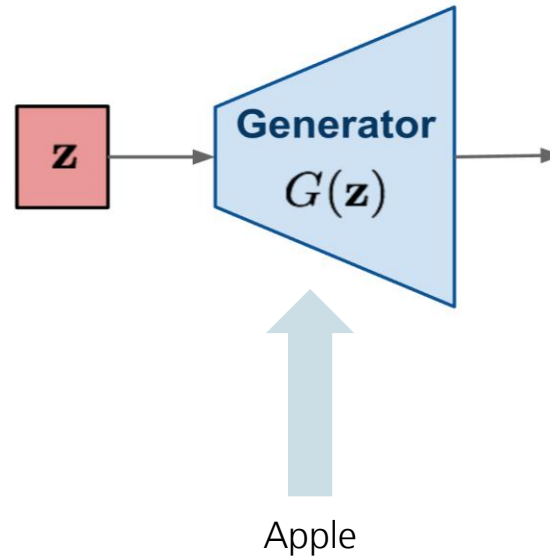
Oranges, Apples, and INVICTA Fruit

Conditional generation



Conditional generation

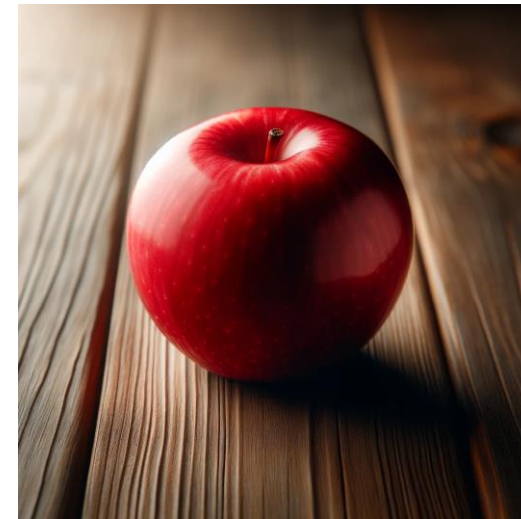
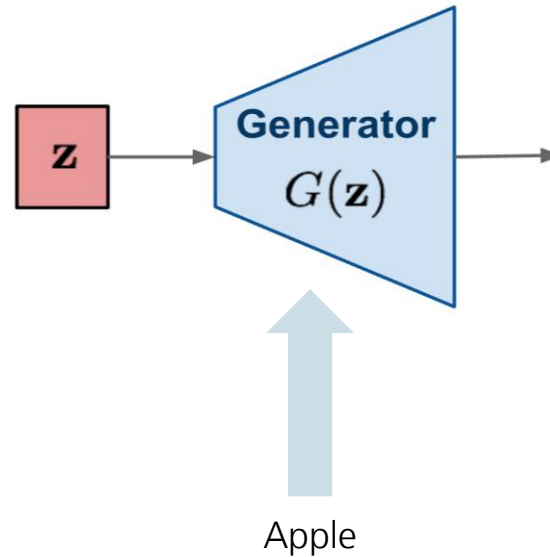
e.g. text to image



<https://chat.openai.com/>
generate an image of an apple

Conditional generation

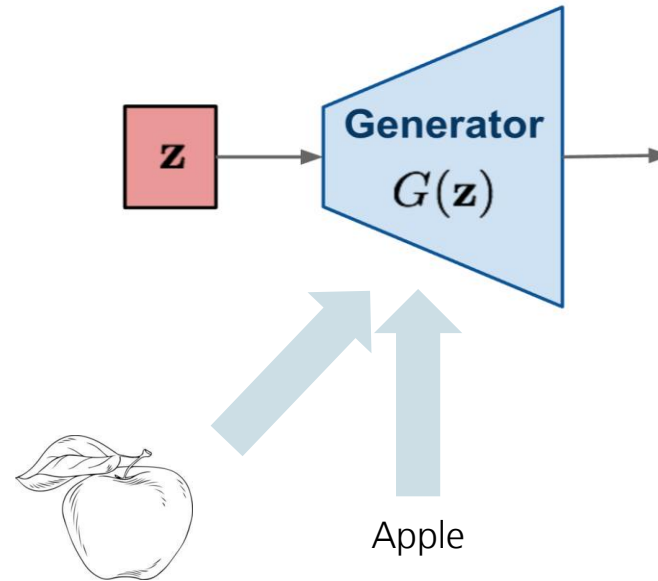
e.g. text to image



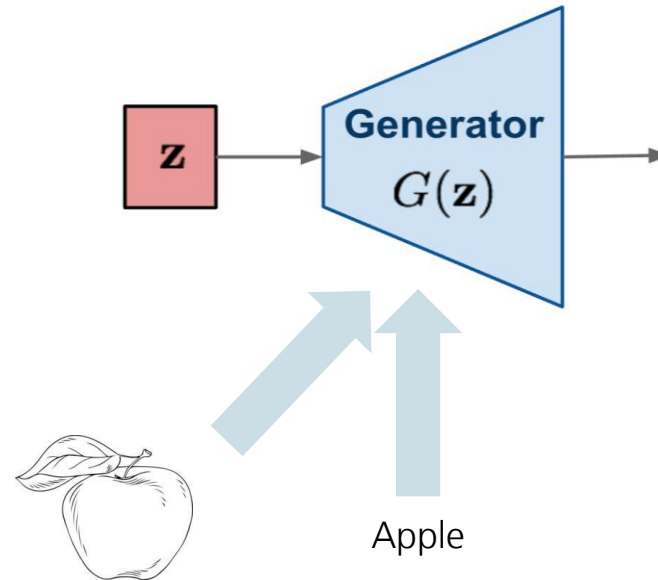
<https://chat.openai.com/>
generate an image of an apple

What about having multiple condition of different modalities

Multi-conditional generation



Multi-conditional generation



<https://huggingface.co/spaces/hysts/ControlNet-v1-1>

One apple fruit – apple laptop – apple with orange skin


Multi-conditional generation

ControlNet v1.1

Duplicate Space for private use

Canny MLSD **Scribble** Scribble Interactive SoftEdge OpenPose Segmentation Depth Normal map Lineart Content Shuffle Instruct Pix2Pix

Image



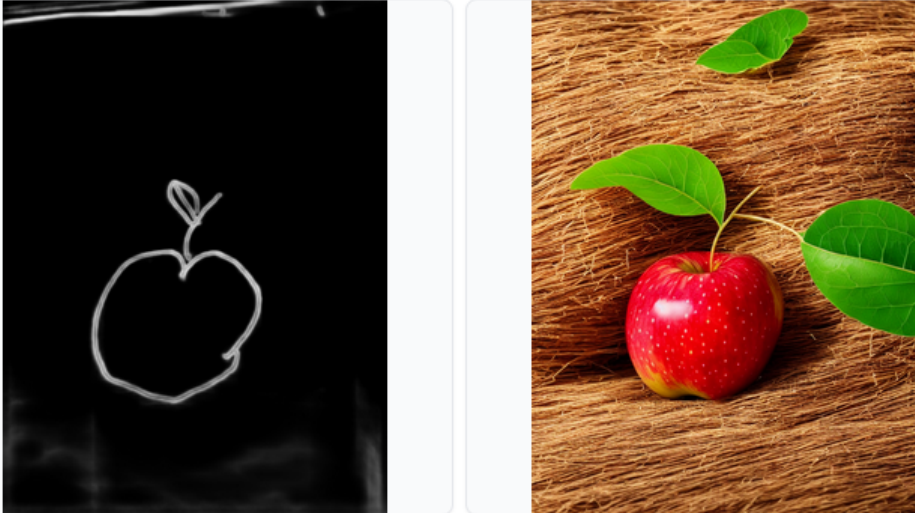
Prompt

an apple fruit

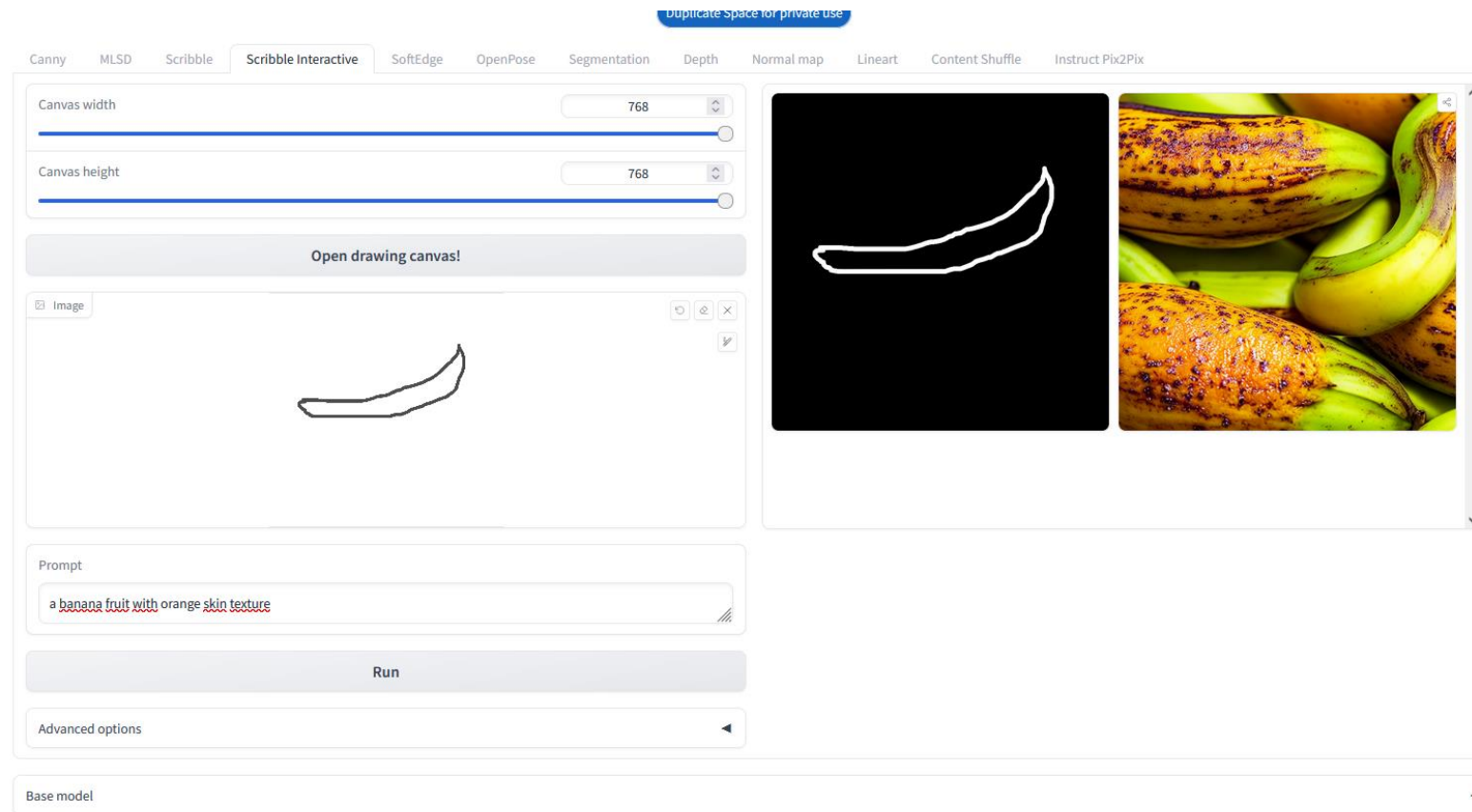
Run

Advanced options

Base model



Or even a new fruit



What do we do?

- Each, let's draw 5-10 sketches of apples
- Each, let's draw 5-10 sketches of oranges
- Each, let's draw 5-10 sketches of INVICTA fruit
- Description:

For me to do

- Scan all the sketches and share them with you
- I am always available for questions and discussions

To do at home

- **Receive the sketches**
- **Use ControlNet to create the fruit images from your sketches**
 - <https://github.com/lllyasviel/ControlNet?tab=readme-ov-file>

Train a classifier – to do at home

- Resnet18 pretrained on imagenet (already well initialized)
- Trained to classify 3 classes using softmax loss.

→ You can even use generation here:

<https://chat.openai.com/>

write a python code in tensorflow framework that loads a resnet18 model trained on imagenet. Add a classification layer to the network with 3 classes.

Train a classifier – to do at home

- Resnet18 pretrained on imagenet
- Trained to classify 3 classes

→ You can even use generative AI

<https://chat.openai.com/>

write a python code in tensorflow to load the pretrained ResNet18 model and add a classification layer to the

```
python Copy code

import tensorflow as tf
from tensorflow.keras.applications import ResNet18
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.models import Model

# Load pre-trained ResNet-18 model trained on ImageNet
base_model = ResNet18(weights='imagenet', include_top=False, input_shape=(224, 224, 3))

# Freeze the pre-trained layers
for layer in base_model.layers:
    layer.trainable = False

# Add classification head
x = Flatten()(base_model.output)
x = Dense(256, activation='relu')(x)
x = Dense(3, activation='softmax')(x) # 3 classes

# Create the final model
model = Model(inputs=base_model.input, outputs=x)

# Compile the model
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# Print model summary
model.summary()
```

trained on imagenet. Add a

To do at home

EXTRA

- Receive the sketches
- Use ControlNet to create the fruit images from your sketches
 - <https://github.com/lllyasviel/ControlNet?tab=readme-ov-file>
- Crawl for real testing data, at least for apples and oranges
- OUR SKETCHES ARE NOT ENOUGH (remember what we need data to be)
 - Introduce variations to the generation process – How?

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