

Ref2: Handwriting Synthesis – Quick Start Guide

This guide walks you through running a basic handwriting generation demo using the **ref2** TensorFlow v2 implementation.

Prerequisites

- **Python 3.7+** (tested with 3.8+)
- **Git** (optional, for cloning)
- **pip or conda** (for dependency management)

Step 1: Navigate to ref2 Directory

```
cd ref2
```

Step 2: Create a Python Virtual Environment (Recommended)

Option A: Using venv

```
python -m venv venv  
source venv/bin/activate          # On Linux/Mac  
# or  
venv\Scripts\activate            # On Windows (PowerShell)
```

Option B: Using conda

```
conda create -n handwriting-synthesis python=3.8  
conda activate handwriting-synthesis
```

Step 3: Install Dependencies

```
pip install -r requirements.txt
```

Step 4: Verify the Model Checkpoint

The repo includes a **pretrained checkpoint** at `model/checkpoint/`. This is required to run generation without training.

Check that the following files exist:

```
ref2/
  └── model/
    ├── checkpoint/
    │   ├── checkpoint
    │   ├── model-17900.data-00000-of-00001
    │   ├── model-17900.index
    │   └── model-17900.meta
    └── style/
        ├── style-0-chars.npy
        ├── style-0-strokes.npy
        ├── ... (more style files)
        └── style-12-strokes.npy
```

If these files are missing, the script will fail. They are already included in the repo.

Step 5: Run the Basic Demo

Execute the main demo script:

```
python main.py
```

What happens: - The script loads the pretrained model from `model/checkpoint/`. - It generates 4 different handwriting demonstrations: 1. **usage_demo.svg** – Multiple lines with varying colors and stroke widths 2. **all_star.svg** – “All Star” lyrics with fixed style and bias 3. **downtown.svg** – “A Thousand Miles” lyrics with varying styles 4. **give_up.svg** – “Hallelujah” lyrics with varying bias (neatness)

Output location:

```
img/
  ├── usage_demo.svg
  ├── all_star.svg
  ├── downtown.svg
  └── give_up.svg
```

Step 6: View the Generated Handwriting

Open any of the .svg files in: - A web browser (Chrome, Firefox, Safari, Edge) - An image viewer - VS Code (with SVG preview extension)

Example:

```
# On Windows
start img/usage_demo.svg
```

```
# On Mac
open img/usage_demo.svg
```

```
# On Linux
xdg-open img/usage_demo.svg
```

Step 7 (Optional): Generate Custom Handwriting

Create a new Python script (e.g., `custom_demo.py`) with:

```
import numpy as np
from handwriting_synthesis import Hand

# Initialize the Hand generator
hand = Hand()

# Define your text
lines = [
    "Hello, World!",
    "This is custom handwriting",
    "Generated by TensorFlow"
]

# Define parameters:
# - biases: Control neatness (0.0 = sloppy, 1.0 = neat)
# - styles: Style indices (0-12 available in model/style/)
biases = [0.75, 0.75, 0.75]
styles = [5, 7, 9]

# Optional: Customize colors and stroke widths
stroke_colors = ['blue', 'green', 'red']
stroke_widths = [1, 1.5, 2]

# Generate SVG
hand.write(
    filename='img/custom_demo.svg',
    lines=lines,
    biases=biases,
    styles=styles,
    stroke_colors=stroke_colors,
    stroke_widths=stroke_widths
)

print("Generated: img/custom_demo.svg")
```

Run it:

```
python custom_demo.py
```

Step 8 (Optional): Experiment with Parameters

Bias (Neatness)

```
# Sloppy handwriting
biases = [0.1, 0.1, 0.1]

# Neat handwriting
biases = [0.9, 0.9, 0.9]

# Mixed
biases = [0.2, 0.5, 0.9]
```

Styles

Available styles: **0 through 12** (13 pretrained styles)

```
# Use different styles per line
styles = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]
```

File Structure

```
/
├── main.py                                # Main demo script (run this)
└── requirements.txt                         # Python dependencies
└── handwriting_synthesis/
    ├── hand/
    │   └── Hand.py                           # Main API: Hand.write()
    ├── rnn/
    │   ├── RNN.py                            # RNN + Attention model
    │   └── LSTMAttentionCell.py
    ├── tf/
    │   └── BaseModel.py                     # TensorFlow utilities
    ├── training/
    │   └── config.py                        # Training utilities (if training)
    │       # Paths and configuration
    └── model/
        ├── checkpoint/                      # model weights
        │   └── style/                          # style embeddings 13 styles
        └── img/                             # Output directory for generated SVGs
        └── logs/                            # Training logs
```

API Quick Reference

```
from handwriting_synthesis import Hand

hand = Hand()
hand.write(
    filename='output.svg',
    lines=['Line 1', 'Line 2'],
```

```
    biases=[0.75, 0.75],           # 0=sloppy, 1=neat
    styles=[5, 7],                 # 0-12 available styles
    stroke_colors=['blue', 'red'], # Optional: RGB or named colors
    stroke_widths=[1, 2]          # Optional: Line thickness
)
```

Output:

Somebody once told me the world is gonna roll me

I ain't the sharpest tool in the shed

She was looking kind of dumb with her finger and her thumb

In the shape of an "L" on her forehead

Never gonna give you up

Never gonna let you down

Never gonna run around and desert you

Never gonna make you cry

Never gonna say goodbye

Never gonna tell a lie and hurt you

Making my way downtown

Walking fast

Faces pass

And I'm home-bound

You are my fire

The one desire

Believe when I say

I want it that way

But we are two worlds apart.

Can't reach to your heart

When you say

That I want it that way

Tell me why

Ain't nothin' but a heartache

Tell me why

Aint nothin' but a mistake

Tell me why

I never wanna hear you say

I want it that way

You are my fire

The one desire

Believe when I say

I want it that way

But we are two worlds apart.

Can't reach to your heart

When you say

That I want it that way

Tell me why

Ain't nothin' but a heartache

Tell me why

Ain't nothin' but a mistake

Tell me why

I never wanna hear you say

I want it that way

You are my fire

The one desire

Believe when I say

I want it that way

But we are two worlds apart -

Can't reach you any more

When you say

That I want it that -

Tell me why

Ain't nothing but a buncha trouble

Tell me why

Ain't nothing but a buncha trouble

Tell me my

I never wanna hear - you say

I want it that way

You are my fire
The one desired
Believe when I say
I want it that way

But we are two worlds apart.
Can't reach to your heart
When you say
That I want it that way

Tell me why
Ain't nothin' but a heartache
Tell me why
Ain't nothin' but a mistake
Tell me why
I never wanna hear you say
I want it that way

You are my fire

The one desire

Believe when I say

I want it that way

But we are two worlds apart..

Can't reach to your heart

When you say

that I want it that way

Tell me why

Ain't nothin' but a heartache

Tell me why

Ain't nothin' but a mistake

Tell me why

I never wanna hear you say

I want it that way

You are my fire
The one desire
Believe when I say
I want it that way

But we are two worlds apart:
Can't reach to your heart
When you say
That I want it that way

Tell me why
Ain't nothin' but a heartache
Tell me why
Ain't nothin' but a mistake
Tell me why
I never wanna hear you say
I want it that way

You are my fire

The one desire

Believe when I say

I want it that way

But we are two worlds apart.

Can't reach to your heart

When you say

That I want it that way

Tell me why

Ain't nothin' but a heartache

Tell me why

Ain't nothin' but a mistake

Tell me why

I never wanna hear you say

I want it that way