

## 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/ # Core package
|_|   |_ hand/
|_|     |_ Hand.py        # Main API: Hand.write()
|_|   |_ rnn/
|_|     |_ RNN.py         # RNN + Attention model
|_|     |_ LSTMAttentionCell.py
|_|   |_ tf/
|_|     |_ BaseModel.py   # TensorFlow utilities
|_|   |_ training/        # Training utilities (if training)
|_|   |_ config.py        # 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  
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

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Can't reach to your heart  
When you say  
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Can't reach you yet

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Tell me why

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But we are two worlds apart..  
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