README

Link to repository: https://github.com/signeaijing/coding3

Link to video demonstration: https://youtu.be/C9Fa9R_fD6s

CONTEXT OF PROJECT

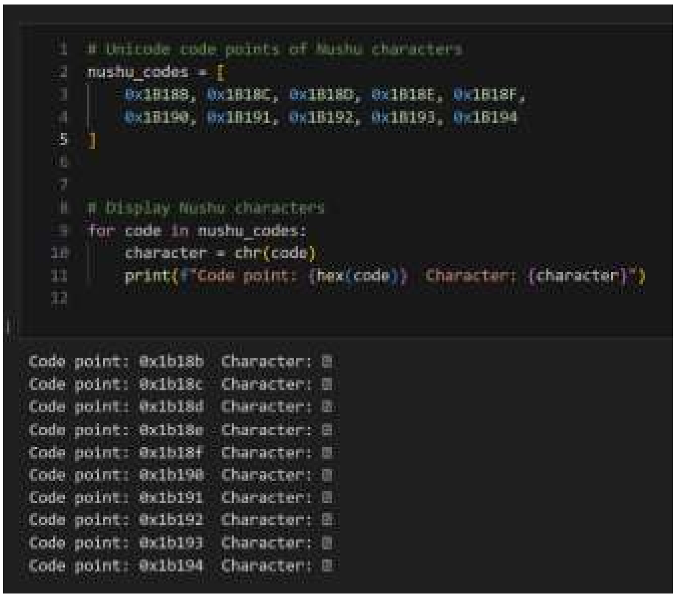
This project is inspired by the nüshu characters of the Jiangyoung dialect, Yang Zhuang (often called tuhua, but that term refers to an inferior language) in the province of Hunan, China. The word, translating literally to ‘women’s script’, was developed by and for women in the Shang or Song dynasty, a time when women were not allowed inside schools and institutions. (Lofthouse, 2020)

It was used by Han, Maio and Yao people and passed down through generations. Therefore, the variations of the scripts are many as each area and each woman would develop their own version that would pass down through generations. (Lofthouse, 2020) Yang Huanyi, the last fluent speaker of the language died in 2004 and therefore the documentation around the script is very limited.

I am drawn to the fluidity and autonomy that lies in this. The aim of this project is to showcase this. I will do this by training DCGAN using this guide: https://pytorch.org/tutorials/beginner/dcgan_faces_tutorial.html (other resources are referenced in the notebook) and then creating an animation based on the generated images, emphasizes how oral practices and dead languages creates gaps between the people who created it and those today.

GETTING THE DATA

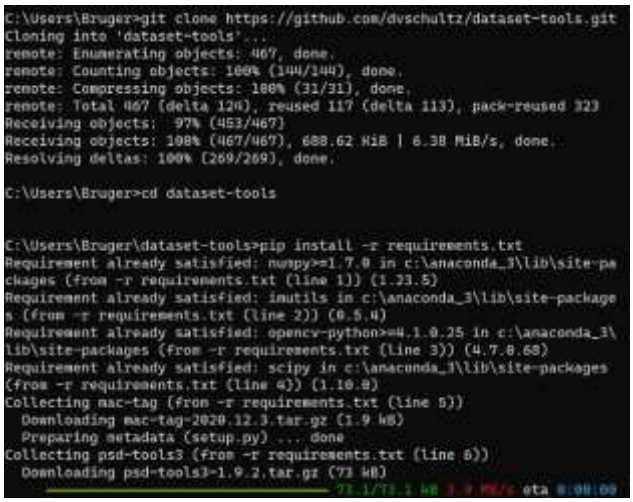
This was the first issue: That there was no dataset available, and the images that I found available to scrape was of very poor quality. I did manage to find unicodes for the script, but I never managed to display it in a notebook even though I tried downloading the .tff files, installing them, converting unicodes and loading in one at a time. The .csv file didn’t even show it either.

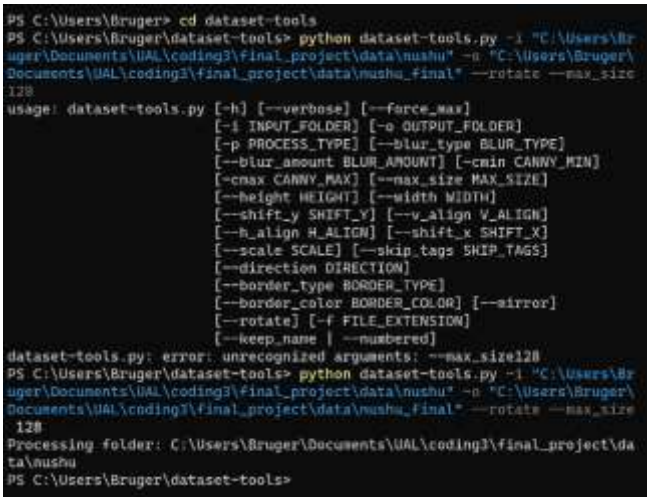


I ended up finding an image containing the characters with unicodes in a grid. I asked ChatGPT to generate code that could split the image into rows x columns of the grid, which provided me with 397 images each depicting one character.

Due to this not being enough data to train on, I used the dataset-tools repository that works through the command line to datawrangle. Repo: https://github.com/dvschultz/dataset-tools

See following pictures:






```
PS C:\Users\Bruger\dataset-tools> python dataset-tools.py --input_folder "C:\Users\Bruger\Documents\UAL\coding3\final_project\nushu_images" --output_folder  "C:\Users\Bruger\Documents\UAL\coding3\final_project\nushu_images_final" --process_type crop_to_square --border_type solid --border_color 255,255,255
```

This produced a dataset of 1588 images.

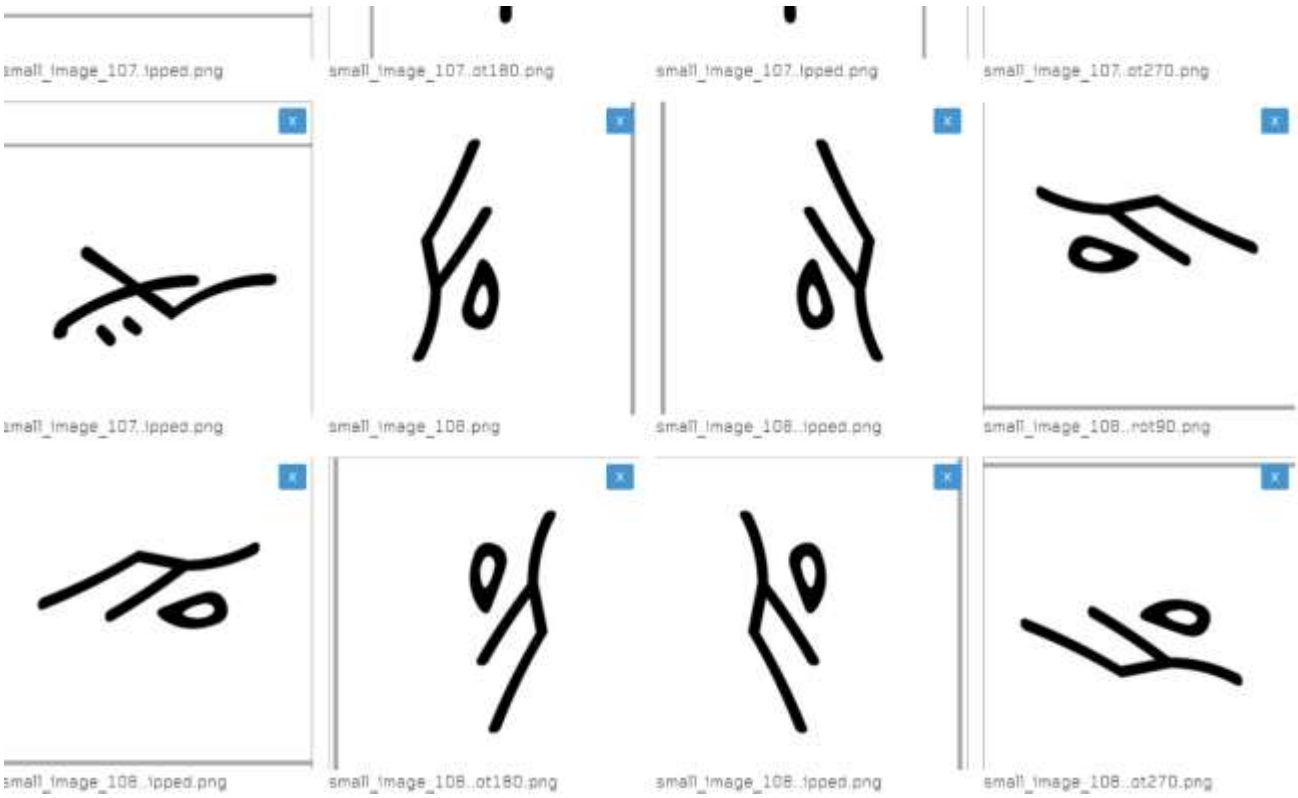
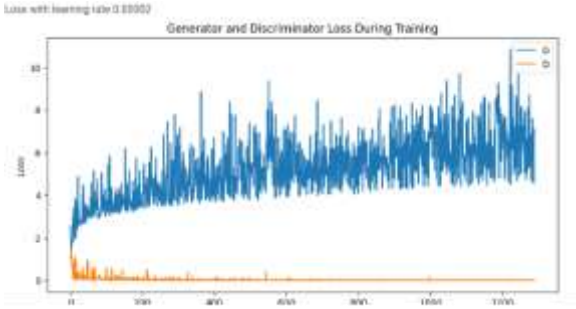


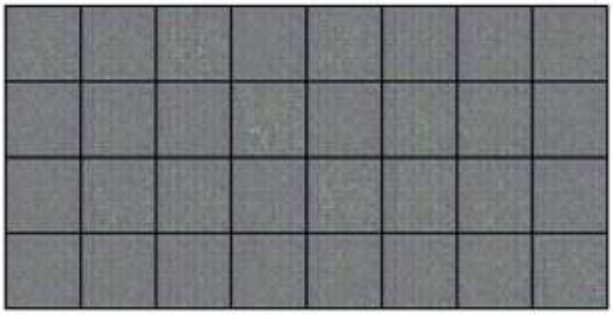
Figure 1 data after wrangling

Then I trained on the DCGAN - see .ipynb notebook for details.

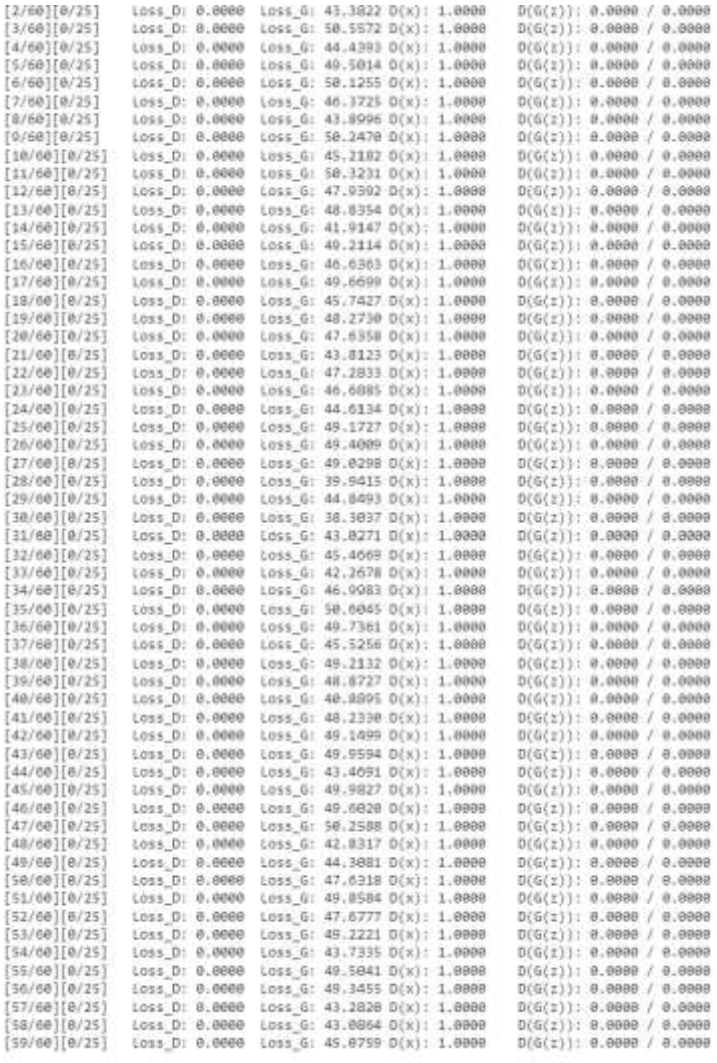
RESULTS

First I got super bad results. The loss output started at around 30 and ended at for the generator and 18 for the discriminator. The output of images was also not good, and the loss for generator and discriminator was horrible.





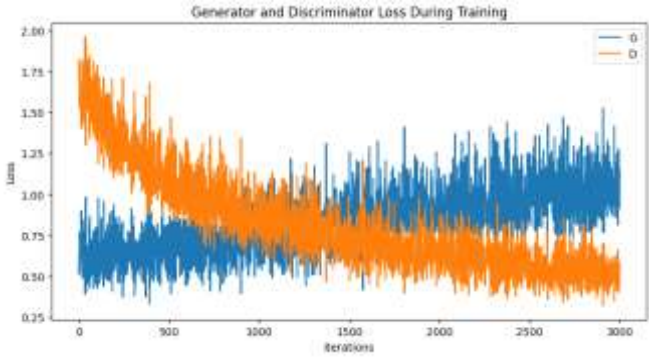
Also the confidence for the discriminator was a 100 percent from the get go for both fake and real images.

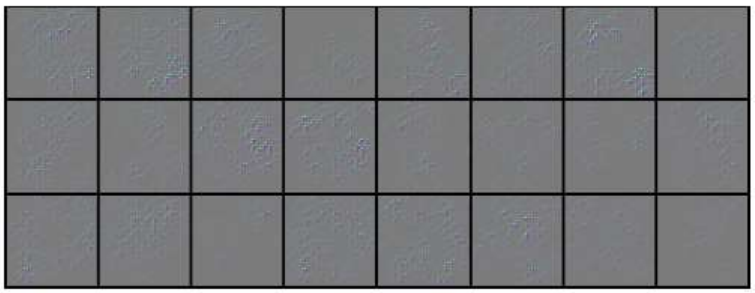


This is the results from the final training.

Therefore, I played around with the hyperparameters like the learning rate, the beta1 parameter for the optimizer, the size of the feature maps for both the generator and the discriminator going between 8 and 64 in order to capture more details. I also trained for between 20-60 epochs. I thought of implementing an early stop, but from this website, I learned that it might have very insignificant impact on the training. https://towardsdatascience.com/10-lessons-i-learned-training-generative-adversarial-networks-gans-for-a-year-c9071159628

I got the same results each time, with only minor improvements in the aesthetics. However, the loss and confidence did improve a lot.





```
[1/60][0/50]    Loss_D: 1.5237  Loss_G: 0.6760  D(x): 0.4445    D(G(z)): 0.5098 / 0.5086
[2/60][0/50]    Loss_D: 1.0197  Loss_G: 0.5301  D(x): 0.4831    D(G(z)): 0.5902 / 0.5886
[3/60][0/50]    Loss_D: 1.4653  Loss_G: 0.5019  D(x): 0.5187    D(G(z)): 0.5547 / 0.5533
[4/60][0/50]    Loss_D: 1.5010  Loss_G: 0.5190  D(x): 0.5525    D(G(z)): 0.5965 / 0.5951
[5/60][0/50]    Loss_D: 1.2744  Loss_G: 0.6522  D(x): 0.5850    D(G(z)): 0.5220 / 0.5209
[6/60][0/50]    Loss_D: 1.1634  Loss_G: 0.7127  D(x): 0.6144    D(G(z)): 0.4915 / 0.4903
[7/60][0/50]    Loss_D: 1.0886  Loss_G: 0.7575  D(x): 0.6486    D(G(z)): 0.4703 / 0.4688
[8/60][0/50]    Loss_D: 1.3652  Loss_G: 0.4879  D(x): 0.6639    D(G(z)): 0.6154 / 0.6139
[9/60][0/50]    Loss_D: 1.2282  Loss_G: 0.5672  D(x): 0.6847    D(G(z)): 0.5689 / 0.5671
[10/60][0/50]   Loss_D: 1.1984  Loss_G: 0.5629  D(x): 0.7033    D(G(z)): 0.5711 / 0.5696
[11/60][0/50]   Loss_D: 1.0758  Loss_G: 0.6449  D(x): 0.7202    D(G(z)): 0.5261 / 0.5247
[12/60][0/50]   Loss_D: 0.9472  Loss_G: 0.7527  D(x): 0.7353    D(G(z)): 0.4726 / 0.4711
[13/60][0/50]   Loss_D: 0.9503  Loss_G: 0.7282  D(x): 0.7484    D(G(z)): 0.4848 / 0.4828
[14/60][0/50]   Loss_D: 1.1262  Loss_G: 0.5568  D(x): 0.7624    D(G(z)): 0.5747 / 0.5730
[15/60][0/50]   Loss_D: 0.9251  Loss_G: 0.7209  D(x): 0.7741    D(G(z)): 0.4878 / 0.4863
[16/60][0/50]   Loss_D: 0.7885  Loss_G: 0.8680  D(x): 0.7850    D(G(z)): 0.4210 / 0.4198
[17/60][0/50]   Loss_D: 1.0052  Loss_G: 0.6210  D(x): 0.7945    D(G(z)): 0.5393 / 0.5374
[18/60][0/50]   Loss_D: 0.9345  Loss_G: 0.6747  D(x): 0.8032    D(G(z)): 0.5100 / 0.5083
[19/60][0/50]   Loss_D: 0.8756  Loss_G: 0.7239  D(x): 0.8111    D(G(z)): 0.4864 / 0.4848
[20/60][0/50]   Loss_D: 1.0316  Loss_G: 0.5748  D(x): 0.8185    D(G(z)): 0.5645 / 0.5628
[21/60][0/50]   Loss_D: 0.8602  Loss_G: 0.7212  D(x): 0.8254    D(G(z)): 0.4874 / 0.4862
[22/60][0/50]   Loss_D: 0.6809  Loss_G: 0.9409  D(x): 0.8318    D(G(z)): 0.3915 / 0.3903
[23/60][0/50]   Loss_D: 0.8671  Loss_G: 0.7001  D(x): 0.8376    D(G(z)): 0.4984 / 0.4965
[24/60][0/50]   Loss_D: 0.7833  Loss_G: 0.7836  D(x): 0.8432    D(G(z)): 0.4581 / 0.4568
[25/60][0/50]   Loss_D: 0.8623  Loss_G: 0.6921  D(x): 0.8483    D(G(z)): 0.5023 / 0.5005
[26/60][0/50]   Loss_D: 0.8185  Loss_G: 0.7394  D(x): 0.8531    D(G(z)): 0.4788 / 0.4774
[27/60][0/50]   Loss_D: 0.7632  Loss_G: 0.7881  D(x): 0.8576    D(G(z)): 0.4564 / 0.4547
[28/60][0/50]   Loss_D: 1.0388  Loss_G: 0.5722  D(x): 0.8618    D(G(z)): 0.5894 / 0.5873
[29/60][0/50]   Loss_D: 0.6887  Loss_G: 0.8714  D(x): 0.8658    D(G(z)): 0.4199 / 0.4184
[30/60][0/50]   Loss_D: 0.7678  Loss_G: 0.7659  D(x): 0.8698    D(G(z)): 0.4665 / 0.4649
[31/60][0/50]   Loss_D: 0.8611  Loss_G: 0.6649  D(x): 0.8733    D(G(z)): 0.5160 / 0.5143
[32/60][0/50]   Loss_D: 0.7461  Loss_G: 0.7815  D(x): 0.8767    D(G(z)): 0.4591 / 0.4577
[33/60][0/50]   Loss_D: 0.7033  Loss_G: 0.8301  D(x): 0.8800    D(G(z)): 0.4376 / 0.4360
[34/60][0/50]   Loss_D: 0.7280  Loss_G: 0.7951  D(x): 0.8830    D(G(z)): 0.4532 / 0.4515
[35/60][0/50]   Loss_D: 0.6765  Loss_G: 0.8568  D(x): 0.8859    D(G(z)): 0.4261 / 0.4245
[36/60][0/50]   Loss_D: 0.6563  Loss_G: 0.8807  D(x): 0.8886    D(G(z)): 0.4162 / 0.4145
[37/60][0/50]   Loss_D: 0.7497  Loss_G: 0.7592  D(x): 0.8912    D(G(z)): 0.4698 / 0.4680
[38/60][0/50]   Loss_D: 0.7789  Loss_G: 0.7242  D(x): 0.8936    D(G(z)): 0.4865 / 0.4847
[39/60][0/50]   Loss_D: 0.5286  Loss_G: 1.0762  D(x): 0.8959    D(G(z)): 0.3421 / 0.3409
[40/60][0/50]   Loss_D: 0.8182  Loss_G: 0.6794  D(x): 0.8981    D(G(z)): 0.5087 / 0.5069
[41/60][0/50]   Loss_D: 0.6044  Loss_G: 0.9363  D(x): 0.9003    D(G(z)): 0.3931 / 0.3921
[42/60][0/50]   Loss_D: 0.6066  Loss_G: 0.9387  D(x): 0.9025    D(G(z)): 0.3959 / 0.3943
[43/60][0/50]   Loss_D: 0.5817  Loss_G: 0.9657  D(x): 0.9046    D(G(z)): 0.3821 / 0.3807
[44/60][0/50]   Loss_D: 0.8386  Loss_G: 0.8770  D(x): 0.9065    D(G(z)): 0.4175 / 0.4160
[45/60][0/50]   Loss_D: 0.4904  Loss_G: 1.1244  D(x): 0.9084    D(G(z)): 0.3258 / 0.3248
[46/60][0/50]   Loss_D: 0.6385  Loss_G: 0.8714  D(x): 0.9103    D(G(z)): 0.4199 / 0.4184
[47/60][0/50]   Loss_D: 0.4876  Loss_G: 1.1217  D(x): 0.9121    D(G(z)): 0.3267 / 0.3257
[48/60][0/50]   Loss_D: 0.5220  Loss_G: 1.0518  D(x): 0.9137    D(G(z)): 0.3507 / 0.3493
[49/60][0/50]   Loss_D: 0.5621  Loss_G: 0.9795  D(x): 0.9153    D(G(z)): 0.3773 / 0.3755
[50/60][0/50]   Loss_D: 0.6101  Loss_G: 0.9014  D(x): 0.9168    D(G(z)): 0.4074 / 0.4060
[51/60][0/50]   Loss_D: 0.5529  Loss_G: 0.9885  D(x): 0.9183    D(G(z)): 0.3736 / 0.3721
[52/60][0/50]   Loss_D: 0.4126  Loss_G: 1.2746  D(x): 0.9198    D(G(z)): 0.2803 / 0.2795
[53/60][0/50]   Loss_D: 0.4888  Loss_G: 1.1034  D(x): 0.9211    D(G(z)): 0.3328 / 0.3317
[54/60][0/50]   Loss_D: 0.5534  Loss_G: 0.9798  D(x): 0.9224    D(G(z)): 0.3766 / 0.3754
[55/60][0/50]   Loss_D: 0.6354  Loss_G: 0.8558  D(x): 0.9236    D(G(z)): 0.4264 / 0.4250
[56/60][0/50]   Loss_D: 0.4657  Loss_G: 1.1390  D(x): 0.9247    D(G(z)): 0.3212 / 0.3201
[57/60][0/50]   Loss_D: 0.5395  Loss_G: 0.9974  D(x): 0.9259    D(G(z)): 0.3703 / 0.3688
[58/60][0/50]   Loss_D: 0.3999  Loss_G: 1.2873  D(x): 0.9271    D(G(z)): 0.2769 / 0.2760
[59/60][0/50]   Loss_D: 0.5887  Loss_G: 0.9143  D(x): 0.9282    D(G(z)): 0.4020 / 0.4008
```

Outcome for the loss for both generator and discriminator goes down while still being quite stable, as well as the confidence for the discriminrator goes up. However, the generated pictures are still not really looking like the training managed to capture the main features of the project.

FINAL REFLECTIONS

The outcome of this project is mildly very disappointing. However, I do know that my intentions and methods could have been sharper. There was a clear obstacle in the language barrier - my mandarin is horrendous as well as the Jiangyoung dialect being very hard to understand, forcing me to derive to aesthetic from my initial intention of making a translation/language-based project.

The images are quite simple and are all black and white resulting in very limited diversity in the generated tensors. Also, I have a feeling that that might make the training a bit weird, as the discriminator quite quickly becomes very good.

If I were to try to carry out this project again, I would probably train on a completely different model.

Additional note added on 16th June:

I JUST stumbled upon this project interpolating between traditional Chinese characters and then trying to incorporate Hangul - the characters used for Korean script. This would have been the perfect model to use for this project, but unfortunately, I discovered it too late to do it for this deadline. Project can be found here: https://kaonashi-tyc.github.io/2017/04/06/zi2zi.html

REFERENCES

Lofthouse, A. (2020). Nüshu: China's secret female-only language. BBC Travel. Retrieved 8th June from https://www.bbc.com/travel/article/20200930-nshu-chinas-secret-female-only-language