

Hypernetwork training for dummies

**Based on my knowledge on 1/9/2022, by
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I'll comment on anything with parenthesis in italics for things I don't know and need confirmation on.

This guide assumes you have decent knowledge of webui and stablediffusion, RTFM.

PREWORD

What is a hypernetwork????

Without getting too science-y, it is an auxiliary model that intercepts the attention layer of the main model and modifies values as it passes through it, sort-of fine tuning without modifying the weights of the main model.

There are reports of being able to train on 8gb of vram but **DO NOT** train hypernetworks with the --medvram argument on, **YOU WILL** get significantly worse results with it on, as reported by some anons

Step 1. GATHER GOOD DATA

The most important and cumbersome part in all of data science, trash goes in; trash goes out, very simple. This step will most likely take up most of the time making your hypernetwork, unless you already happen to have it on hand...

The cleaner reference of an artist's style or a subject, the better, consistent quality and style, no text, symbols, etc, everything that can give the model a cleaner and more detailed look on whatever you want will make your hypernetwork happy.

There are plenty of things you can do to make bad data into good data, like...

- 1.Editing the image yourself to erase anything you don't want fed to the model (like text).
- 2.Cropping it or resizing the canvas of the image so its in a more better ratio for preprocessing later.
- 3.[AI](#) Upscaling it if its lower than you training resolution (I suggest using cupscale, look it up and find the best model for your images).

Step 2. SETTINGS AND OTHER THINGS

WD 1.4 Tagger script, tab, installed Interrogates single or multiple image files using various alternative models, similar to deepdanbooru interrogate. Installed

Install this from the extension tab! it is an excellent interrogator for danbooru-based models

Installed Available Install from URL

URL for extension's git repository

<https://github.com/aria1th/Hypernetwork-MonkeyPatch-Extension>

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Install this extension by placing this url in the "Install from URL" tab in the extension tab, creates 2 new tabs in the "Train" tab in webui, allows the creation of "beta hypernetworks" which mostly allows you to use dropout in a more efficient manner by specifying the percentages of which weights in a hypernetwork layer to not update. Allows you to train without needing to crop/resize images in the "Train_Gamma" tab, however you will not be able to increase batch sizes... but considering how cumbersome preprocessing can be it is very much worth using.

Saving images/grids

Paths for saving

Saving to a directory

Upscaling

Face restoration

System

Training

- Move VAE and CLIP to RAM when training if possible. Saves VRAM.
- Turn on pin_memory for DataLoader. Makes training slightly faster but can increase memory usage.
- Saves Optimizer state as separate *.optim file. Training of embedding or HN can be resumed with the matching optim file.

Filename word regex

Filename join string

Number of repeats for a single input image per epoch; used only for displaying epoch number

100

Save an csv containing the loss to log directory every N steps, 0 to disable

500

Use cross attention optimizations while training

Images Browser

Actions

Licenses

Turn on "Saves Optimizer state as separate .optim file. Training of embedding or HN can be resumed with the matching optim file." This is necessary to continue training when you're done or returning to a previous checkpoint, continuing training without it will lead to a quick HN failure.

Step 3. MAKING YOUR HYPERNETWORK FILE, PREPROCESSING

See [wiki](#) for detailed explanation.

Create embedding **Create hypernetwork** Preprocess images Train

Name

Modules

768 320 640 1280

Enter hypernetwork layer structure

1, 2, 1

Select activation function of hypernetwork

linear

Add layer normalization

Use dropout

Overwrite Old Hypernetwork

Create hypernetwork

Set the name to the style, subject, or whatever you're training on (try not to name it something overtly generic or something that could pull in a lot of token weight, as this will reflect later in the training prompt if you decide to use [name] in the style filewords txt). Don't uncheck any of the boxes, voldy stated this.



AUTOMATIC1111 yesterday Maintainer

edited · · ·

768 is a module that processes inputs,

320 640 1280 are modules that process intermediate results, the larger than number the closer to the center of the network those modules are placed (as far as I know).

numerical value is the third dimension of input for cross attention layer

hypernet is injected into the cross attention layer, and when the context input for the cross attention layer has matching shape (your prompt, has a shape of [x,x,768], while three other sizes are related to self-attention of convolutional layers (i hope i'm not messing the terminology up)).

(May or may not reduce or improve the quality of your output, experimentation needed!)

Layer structure can be kept at default. Experimentation is very much welcome however, you can add more or bigger number between the first and last 1, like 1, 1.5, 1.5, 1 or 1, 3, 1

There are a lot of numbers being thrown around in regards to layer structures (*Yet no actual comparisons to prove its meaningful when it comes to training towards certain concepts, such as styles or characters...*) but it is certainly worth messing around with.

Generally adding more or larger layers can make your hypernetwork more resilient to its weights exploding and allows it to store more data, however it'll increase the amount of time it'll take to successfully train one, decrease generation speed, and significantly increase the size of your hypernetwork file

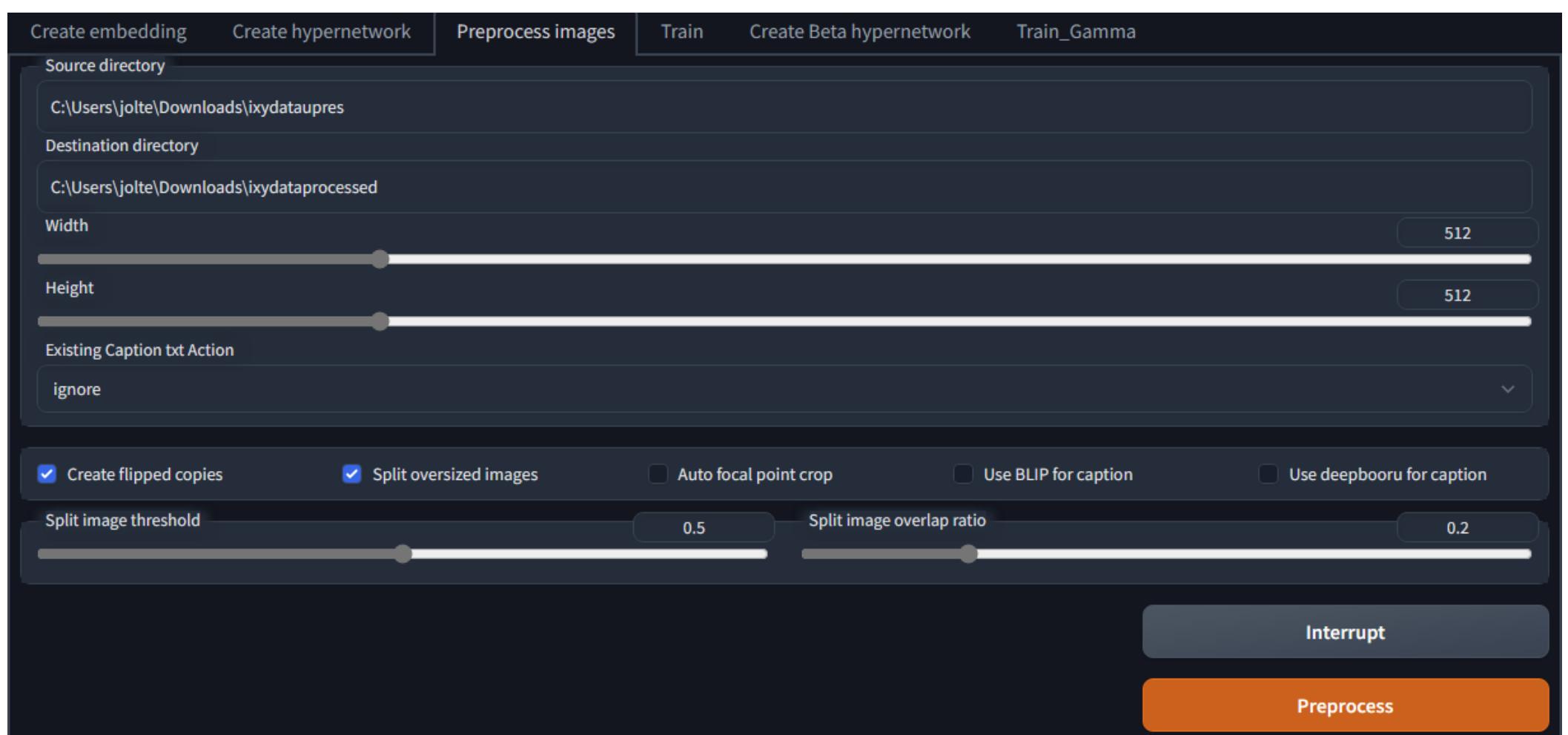
Activation function can be set to linear for the tried-and-true method, you can experiment with all the others if you have the time.

Swish/Mish is slightly slow but very safe and good to use

Dropout can be useful for delaying overfit/exploding weights but will significantly slow down training

Layer normalization is not worth it. **Do not use it.**

Layer weight initialization other than normal may immediately kill your hypernetwork upon starting (less than 500 steps) without using layer normalization, make sure you know what you're doing if you choose to use them.



Set resolution to whatever resolution you're going to be training on, **do not set it to anything else**. Use a 1:1 aspect ratio, make your images square. You CAN train with other aspect ratios, but it isn't recommended and voldy says it produces worse results. Whatever you pick here will be the resolution you use during the training process.

Creating flipped copies may help, but there isn't anything concrete whether it helps overfitting or not.

Splitting oversized images into two is up to your data, tick it on if your data is very long or tall, if you did not tick it on and it isn't 1:1, it'll resize down (keeping the ratio of the image), then crop out from the middle portion, this could be bad if what you want to be training on gets cut out, like a person lying horizontally throughout the image

Have all your data in one folder, make a new folder for your output and just copy+paste the file directories from explorer.

Hit the preprocess button and look at it go, everything should be in the destination directory.

txt2img img2img Extras PNG Info Checkpoint Merger Train Create aesthetic embedding Image Browser Dreambooth Smart Preprocess Tagger

Single process **Batch from directory**

Input directory: C:\Users\jolte\Downloads\xydataprocessed

Use recursive with glob pattern

Output directory: Leave blank to save images to the same path.

Output filename format: [name].[output_extension]

Output filename formats

Action on exiting caption: ignore

Save with JSON

Interrogate

Preset: default.json

Interrogator: wd14-vit

Unload all interrogate models

Threshold: 0.35

Additional tags (split by comma)

Exclude tags (split by comma)

Sort by alphabetical order

Include confident of tags matches in results

Use spaces instead of underscore

Excludes (split by comma): 0_0, (o)_o, +_+, +_-, ._, <o>_<o>, <|>_<|>, =_=, >_<, 3_3, 6_9, >_o, @_@, ^_^, o_o, u_u, x_x, |_|, ||_|

Escape brackets

Unload model after running

Using the wd 1.4 interrogation extension is very useful for your training prompt, I suggest having it on if you don't have a source of tags for every single one of your images already (including the crops done by the split into two setting, good luck with that one lol)

Go to the "Batch from directory tag" and put down the folder of the processed images, most of the settings should be left untouched except for "Unload model after running", that should be ticked on so it isn't just sitting in your vram when you start training. Click the "interrogate" button and it will caption all of your images in the processed folder with .txt files next to each image.

<https://github.com/arenatemps/sd-tagging-helper>

This is a very useful all-in-one tool for properly preprocessing and tagging your dataset, you can basically skip the preprocessing step and do it all in this application instead! Proper tagging what you want the hypernetwork to learn from your dataset is an immensely helpful for its success, always remember **quality over quantity**

Most of this can be skipped by using the "Train_Gamma" tab if you choose to use the hypernetwork monkeypatch extension since it will automatically resize your images when training, you really only have to have them captioned using the wd 1.4 interrogation extension (or captioned manually)

STEP 4. TRAINING SETTINGS

See [wiki](#) for detailed explanation.

Create embedding

Create hypernetwork

Preprocess images

Train

Create Beta hypernetwork

Train_Gamma

Train an embedding or Hypernetwork; you must specify a directory [[wiki](#)]

Embedding



Hypernetwork

ixy(3a661e48)



Embedding Learning rate

0.005

Hypernetwork Learning rate

0.00001

Show advanced learn rate scheduler options(for Hypernetworks)

Show advanced adamW parameter options(for Hypernetworks)

Unload Optimizer when generating preview(hypernetwork)

Batch size

1

Gradient accumulation steps

1

Dataset directory

C:\Users\jolte\Downloads\xiydataprocessed

Log directory

textual_inversion

Prompt template file

D:\stable-diffusion-webui\textual_inversion_templates\style_filewords.txt

Width

512

Height

512

Max steps

100000

Save an image to log directory every N steps, 0 to disable

500

Save a copy of embedding to log directory every N steps, 0 to disable

500

Save images with embedding in PNG chunks

Read parameters (prompt, etc...) from txt2img tab when making previews

Drop out tags when creating prompts.

0

Shuffle tags by ; when creating prompts.

Choose latent sampling method

once

deterministic

random

Set the hypernetwork to the one you just made.

Set learning rate to the one suggested by voldy, in my case I put down 5e-6, this will guarantee decent results but depending on your data (and activation method or if you used dropout or not), this will most likely start to overtrain and start killing your hypernetwork somewhere between 9000~25000 mark, you can attempt to avoid this by setting a training scheduler, an example would be **5e-6:12000, 5e-7:30000** (just an example, don't actually use this unless you're well acquainted with HN training and the correlation between hypernetwork death, training rates, stepcounts, and activation methods), once it reaches past 12000 it will switch to a lower training rate to sidestep the effects of possibly over training and killing your hypernetwork.

Set dataset directory to wherever you have you preprocessed data located

The log directory is where your hypernetwork and preview output will be located, sorted by date and specific hypernetwork

The prompt template file is what your training prompt is going to be I cleared it out and only left a single [fileword], [name] there, don't think anything else is necessary unless you're doing something not anime art related and want it set to whatever.

Appending masterpiece, best quality before filewords or mixing them all together like

masterpiece, best quality, [filewords], [name]

masterpiece, [filewords], [name]

best quality, [filewords], [name]

[filewords], [name]

May provide increased effectiveness of your training prompt (*I have only seen one comparison where it helped one anon, but plenty of other well-done hypernetworks are built using the template above so it may be worthwhile, if you are wary of it, the template below is fine*)

none.txt - Notepad

File Edit Format View Help

[filewords], [name]

Ensure you are training on a 1:1 ratio for resolution, you *can* train on different resolution but as said before, you'll see a drop in quality. (*Need to see examples of this, experimentation needed!*)

Max steps can be left alone unless you're planning on really going farther than that, **you most likely won't** and you can stop at any time since your progress is saved, you can set it lower if you're going to be running it overnight and are worried about electricity cost.

Save an image/embedding to log directory can be left as is unless you're tight on space or paranoid, every 500 steps or whatever you set it at will save in the previously mentioned log directory.

Turn this setting on and in the txt2img tab, put whatever you foresee you using with your hypernetwork or whatever you believe would be the best way to look at how much its progressing, this will effect the image it generates and saves.

Read parameters (prompt, etc...) from txt2img tab when making previews

Turn on tag shuffling, may help with overfit/weight explosion, drop out tags might help too but don't set it very high.. (less than .3)

Ensure you have "Choose latent sampling method" set to deterministic or random (random could be better but incurs a performance penalty, deterministic will suffice", do NOT have it set to "Once" or the VAE will not be correctly sampled which could lead to hypernetwork death when training over many iterations

Consider messing around with the advanced learn rate scheduler if you're familiar with learning rate scheduler algorithms, can be very useful compared to the constant rate webui training is limited to.

Now hit the train hypernetwork button and watch it go!!!

Step 5 TRAINING AND TESTING

Now this is where things get really subjective, I'm not going to say much on this due to how much it will vary from person to person, their standards on quality, your data, and your training rate. Do not ask when it will start looking good.

You can probably guess when your training is going kaput like strange artifacts showing, if you feel like its turning to garbage at a certain point, go back a few thousand steps and start training again with an extra 0 to your training rate (going lower than 5e-7 is most likely unnecessary and probably won't do much at all unless you have A LOT of time, just find an earlier point when it starts going downhill and continue at 5e-7 from there)

Resuming after interrupting training may lead to a quick death of the hypernetwork if you did not check the "Saves Optimizer state as separate .optim file. Training of embedding or HN can be resumed with the matching optim file." option on in webui settings

What I do afterwards is copy every single .pt file saved in \stable-diffusion-webui\textual_inversion\datehere\hypernetworknamehere and copy it over to \stable-diffusion-webui\models\hypernetworks, you can refresh the list of hypernetworks in webui with this button

Stable Diffusion

Hypernetwork
ixyartattempt2-11500

Hypernetwork strength 1

Apply color correction to img2img results to match original colors.

Save a copy of image before applying color correction to img2img results

With img2img, do exactly the amount of steps the slider specifies (normally you'd do less with less denoising).

Enable quantization in K samplers for sharper and cleaner results. This may change existing seeds. Requires restart to apply.

Emphasis: use (text) to make model pay more attention to text and [text] to make it pay less attention

Use old emphasis implementation. Can be useful to reproduce old seeds.

Make K-diffusion samplers produce same images in a batch as when making a single image

Increase coherency by padding from the last comma within n tokens when using more than 75 tokens 20

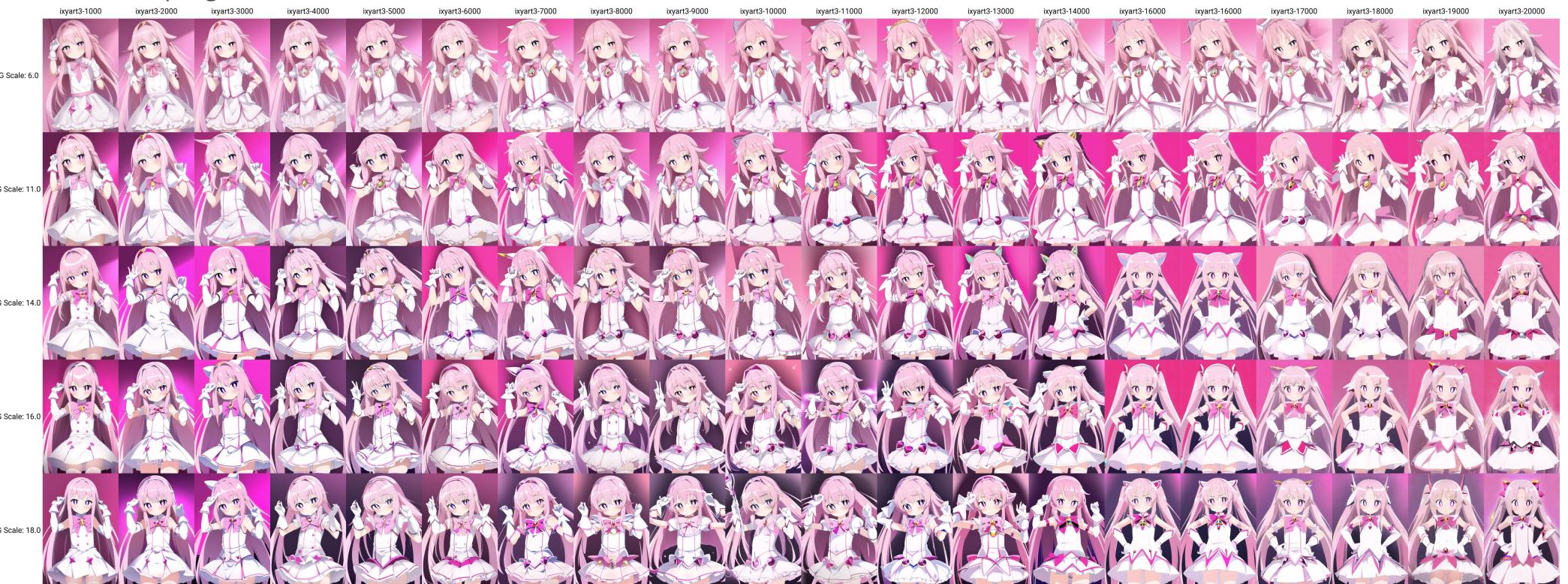
Filter NSFW content

Stop At last layers of CLIP model 1

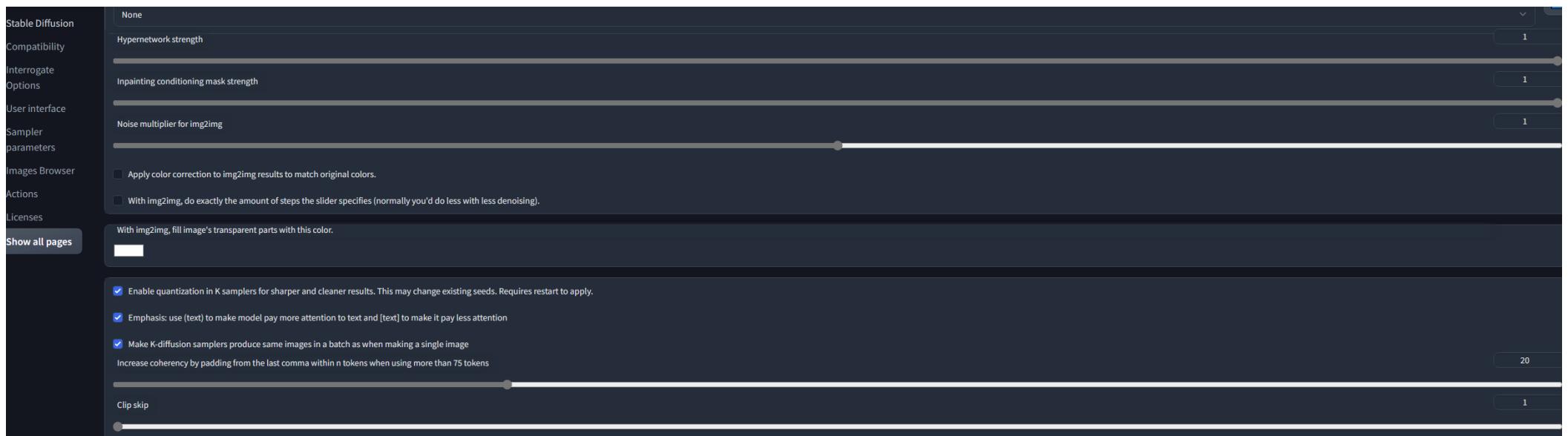
You can make an x/y plot with the name of your hypernetworks on the x and some random seeds on your y, to see how well each iterations went, you can set any other parameter to whatever you feel would be best.

Then you can continue testing on the y with cfg, sampling steps, whatever you feel like would put your hypernetwork iteration to the test to find the perfect iteration!

Here is an example grid...



If you feel like your results are disappointing, make sure your clipskip is set to 1 (this turns it OFF), your output may change dramatically in your favor, experiment! VAE may interfere as well but most likely won't if sampled correctly



I will not be covering any tech support related questions, better off asking your friends or on the thread.

Good luck, you'll need it.

I'm going to start a change log starting from 10/18/2022, so people re-reading this guide can see if anything is new.

10/18/2022

Changed step 4 to mention scheduling your training rates for streamlining your training rates.

Reworded step 5 and added a bit on just starting from an earlier point before training starts going bad and restarting from there at a lower training rate.

10/20/2022

Updated step 3 with the new layer structure and normalization option.

10/22/2022

Updated step 3 with new activation function option.

10/23/2022

More activation functions...

added mention of dropout, use it, its good!

10/25/2022

Updated step 3 and 4, clarifying some activation methods and training rates

10/31/2022

Updated step 3 and 5

Mentioned <https://github.com/arenateemp/sd-tagging-helper> in step 3, use it!

Mentions of layer weight initialization in step 3

Mentions of interrupting/resuming training in step 5

11/7/2022

Updated step 2 with a new images showing having optimizer saves checked.

Updated step 3 on info about layer structures and the importance of trying out wider/larger structures.

Updated step 5 to mention having optimizer saves checked.

1/9/2023

Rewritten massive portions of the guide to keep up with the new methods and tools... sorry for the wait! most of it is completely different so please give it another read!