Re: Question about ParallelProj library

De : Georg Schramm <georg.schramm@kuleuven.be>
Objet : Re: Question about ParallelProj library
À : Mauricio Salim GOMEZ CHICRE <mauricio-salim.gomez-chicre@eleves.ec-nantes.fr>

dim., 24 mars 2024 19:21
📎 3 pièces jointes

Hi Mauricio,

you indeed need to "detach" the tensor.

If you want to train models with projectors, I recommend to have a look
at the 2023 MIC shortcourse that I gave.
Specifically at the "forward and back projection" with custom linear operator
(e.g. parallelproj projectors) as defined here:

https://github.com/gschramm/2023-MIC-ImageRecon-Shortcourse/blob/main/layers.py

a minimal example that you can run in parallelproj is also included in the docs of
parallelproj >=1.7 here:
https://parallelproj.readthedocs.io/en/stable/auto_examples/07_torch/01_run_projection_layer.html#sphx-glr-auto-examples-07-torch-01-run-projection-layer-py

Bests,
Georg

Btw: If you want to do "serious" network training, I highly recommend running everything
on a GPU. E.g. by using parallelproj directly with pytorch "GPU" tensors (and not with
numpy arrays)

From: Mauricio Salim GOMEZ CHICRE <mauricio-salim.gomez-chicre@eleves.ec-nantes.fr>
Date: Saturday, 23 March 2024 at 18:50
To: Georg Schramm <georg.schramm@kuleuven.be>
Cc: Áureo Henrique E SILVA MARQUES <aureo-henrique.e-silva-marques@eleves.ec-nantes.fr>, younes moussaoui <younes.moussaoui@ec-nantes.fr>, Diana Mateus <Diana.Mateus@ls2n.fr>
Subject: Re: Question about ParallelProj library

Hi Georg,

First of all, thank you very much for the help ! I'm now getting the projections correctly !

However, I would like to ask for your help again.

I'm training a model for the reconstruction of a phantom and I needed the projector, while training, to transform the output to the sinogram while it's a tensor attached to the model. I have tried the projector on tensors, and it works correctly, but when I try to use it on the tensor output of the model it asks me to detach it from the model, which I can't do.

I copy you the error I'm getting :

```
{
"name": "RuntimeError",
"message": "Can't call numpy() on Tensor that requires grad. Use tensor.detach().numpy() instead.",
"stack": "---------------------------------------
RuntimeError                    Traceback (most recent call last)
Cell In[31], line 34
     29 pred = pred.view(400,400)
     31 ## Projection of new sinogram
---> 34 new_sino = proj(pred)
     35 new_sino = torch.from_numpy(new_sino)
     38 ## Calculate loss

File ~/anaconda3/envs/ParallelProj/lib/python3.11/site-packages/parallelproj/operators.py:72, in LinearOperator.__call__(self, x)
     70 def __call__(self, x: Array) -> Array:
     71    \"\"\"alias to apply(x)\"\"\"
---> 72    return self.apply(x)

File ~/anaconda3/envs/ParallelProj/lib/python3.11/site-packages/parallelproj/operators.py:66, in LinearOperator.apply(self, x)
     55 \"\"\"(scaled) forward step :math: 'y = \\\\alpha A x'
     56
     57 Parameters
     (...)
     63 Array
     64 \"\"\"
     65 if self._scale == 1:
---> 66    return self._apply(x)
     67 else:
     68    return self._scale * self._apply(x)

File ~/anaconda3/envs/ParallelProj/lib/python3.11/site-packages/parallelproj/projectors.py:155, in ParallelViewProjector2D._apply(self, x)
     151 def _apply(self, x: Array) -> Array:
     152    y = parallelproj.joseph3d_fwd(
     153       self._xstart,
     154       self._xend,
--> 155       self.xp.expand_dims(x, axis=0),
     156       self._image_origin,
     157       self._voxel_size,
     158    )
     159    return y

File ~/anaconda3/envs/ParallelProj/lib/python3.11/site-packages/numpy/lib/shape_base.py:591, in expand_dims(a, axis)
     589    a = asarray(a)
     590 else:
---> 591    a = asanyarray(a)
     593 if type(axis) not in (tuple, list):
     594    axis = (axis,)

File ~/anaconda3/envs/ParallelProj/lib/python3.11/site-packages/torch/_tensor.py:1062, in Tensor.__array__(self, dtype)
     1060    return handle_torch_function(Tensor.__array__, (self,), self, dtype=dtype)
     1061 if dtype is None:
-> 1062    return self.numpy()
     1063 else:
     1064    return self.numpy().astype(dtype, copy=False)

RuntimeError: Can't call numpy() on Tensor that requires grad. Use tensor.detach().numpy() instead."
}
```

I hope you're able to help and I thank you in advance.

Kind regards,
Mauricio.

De: "georg schramm" <georg.schramm@kuleuven.be>
À: "Mauricio Salim GOMEZ CHICRE" <mauricio-salim.gomez-chicre@eleves.ec-nantes.fr>
Cc: "Áureo Henrique E SILVA MARQUES" <aureo-henrique.e-silva-marques@eleves.ec-nantes.fr>, "younes moussaoui" <younes.moussaoui@ec-nantes.fr>, "Diana Mateus" <Diana.Mateus@ls2n.fr>
Envoyé: Vendredi 22 Mars 2024 19:04:07
Objet: Re: Question about ParallelProj library

Hi Mauricio,

glad to hear that you are using parallelproj.

In ParallelViewProjector2D, the "views" are rotated around the
world coordinate point (0,0) -> not well documented.

That means that the radial position should be "symmetric" around
0. e.g.
```
radial_positions = np.linspace(-99.5,99.5,180)
```

Then you also have to make sure that the "image origin"
The "world coordinate" of the [0,0] voxel of your image is correct.

E.g. if you have an image with 50x50 voxels of 2mm that is centered
around (0,0), the img_origin in world coordinates should be (-49,-49).

This example here uses the ParallelViewProjector2D to due 2D MLEM
(line 267)

https://parallelproj.readthedocs.io/en/stable/auto_examples/05_algorithms/05_run_fbp.html#sphx-glr-auto-examples-05-algorithms-05-run-fbp-py

Bests,
Georg

From: Mauricio Salim GOMEZ CHICRE <mauricio-salim.gomez-chicre@eleves.ec-nantes.fr>
Date: Friday, 22 March 2024 at 17:46
To: Georg Schramm <georg.schramm@kuleuven.be>
Cc: Áureo Henrique E SILVA MARQUES <aureo-henrique.e-silva-marques@eleves.ec-nantes.fr>, "younes.moussaoui@ec-nantes.fr" <younes.moussaoui@ec-nantes.fr>, Diana Mateus <Diana.Mateus@ls2n.fr>
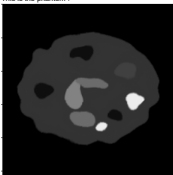**Subject:** Question about ParallelProj library

Hello Georg !

My name is Mauricio, I'm a student and I'm currently doing a project in PET reconstruction.

In doing so, I found the library you created and I have been trying to use it for forward projections of some 2D phantoms. However, I have been having some problems.

I have been trying to use **ParallelViewProjector2D**. I don't know if you could help understand how it works, as I think the problems are due to me not fully understanding it.
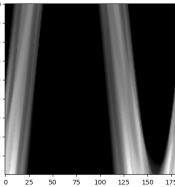
This is the phantom :

This is how I have been using it :

```
radial_positions = np.linspace(0, 180,180)

view_angles = np.linspace(0,2*math.pi,180)

proj2D = parallelproj.projectors.ParallelViewProjector2D((256,256), radial_positions, view_angles, 300, (0,0), (2,2))
x_fwd = proj2D(phantom)
```

And this is the result I have been getting.

I would really appreciate the help to get the correct sinogram.

Kind regards,
Mauricio Gómez