Final Presentation Q&A

April 21, 2022

Q1. Examples of functions belonging and not belonging to space of second ordered bounded variation functions BV$^{(2)}(\mathbb{R})$.

- Any kind of continuous piecewise linear (CPWL) functions, for example ReLU or its variants such as shifted ReLU, LeakyReLU, PReLU etc belongs to BV$^{(2)}(\mathbb{R})$ as these kinds of functions for any $x_0 \in \mathbb{R}$, the left and right derivates exist and are finite at x_0.

- An example of function not belonging to BV$^{(2)}(\mathbb{R})$ would not satisfy the above condition, for example −

$$f(x) = \begin{cases} x\sin(\log(x)), & x > 0 \\ 0, & x \leq 0 \end{cases} \tag{1}$$

Here $f(x)$ does not have a right derivative at the point $x_0 = 0$.

Q2. What is the step size used while training the deep spline network?

We have used the ADAM optimizer, we have set the step size or the learning rate for this experiment as 10^{-3}. Below is an image showing the training parameters.

```
Parameters :
{'net': 'twoDnet', 'device': 'cuda:0', 'log_dir': './ckpt', 'num_epochs': 500, 'milestones': [440, 480], 'lips
chitz': False, 'lmbda': 1e-05, 'optimizer': ['Adam'], 'lr': 0.001, 'weight_decay': 1e-05, 'log_step': 150, 'va
lid_log_step': 37500, 'verbose': False, 'model_name': 'twoDnet_deepBspline_lambda_1.0E-05', 'mode': 'train', '
knot_threshold': 0.0, 'aux_lr': 0.001, 'gamma': 0.1, 'resume': False, 'resume_from_best': False, 'ckpt_filenam
e': None, 'ckpt_nmax_files': 3, 'additional_info': [], 'num_classes': None, 'dataset': {'dataset_name': 'circl
e', 'log_dir': './ckpt', 'model_name': 'twoDnet_deepBspline_lambda_1.0E-05', 'plot_imgs': False, 'save_imgs':
False}, 'dataloader': {'data_dir': './data', 'batch_size': 10, 'num_workers': 4, 'test_as_valid': True, 'seed'
: -1}, 'model': {'activation_type': 'deepBspline', 'spline_init': 'leaky_relu', 'spline_size': 21, 'spline_ran
ge': 1, 'save_memory': False, 'knot_threshold': 0.0, 'num_hidden_layers': 2, 'num_hidden_neurons': 4, 'net': '
twoDnet', 'verbose': False, 'num_classes': 2}}
ckpt validation accuracy : 99.267%
```