

Data Book

Context-Aware Medical Image Super-Resolution Using Convolutional Neural Networks

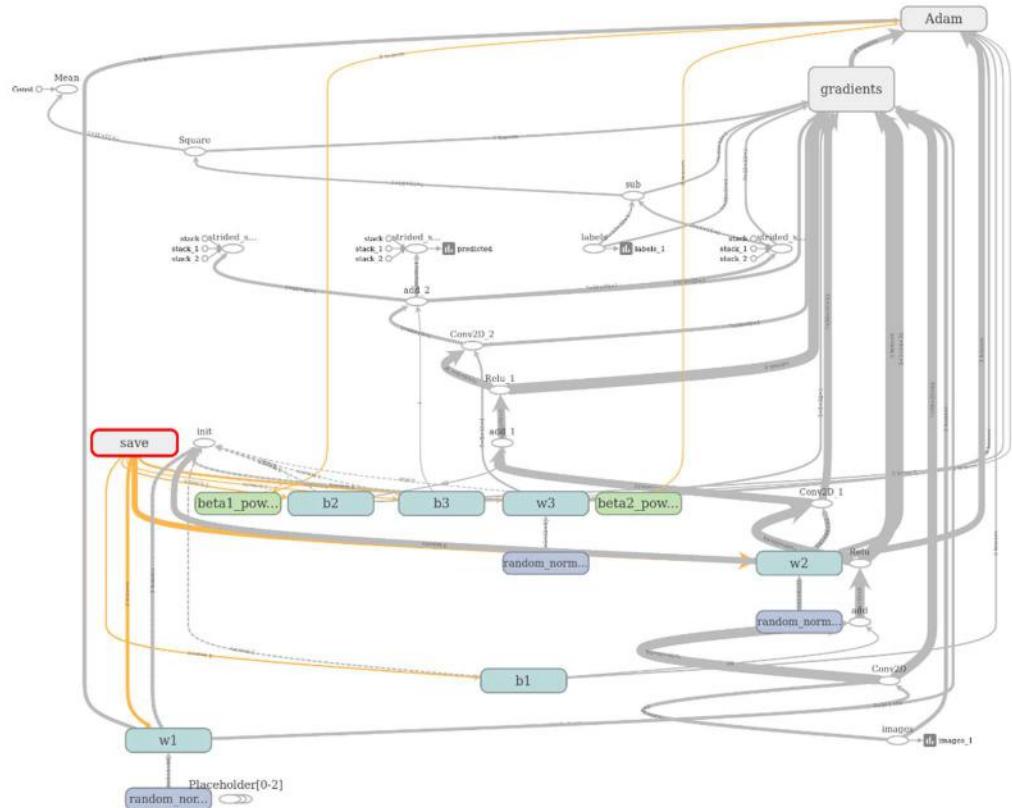
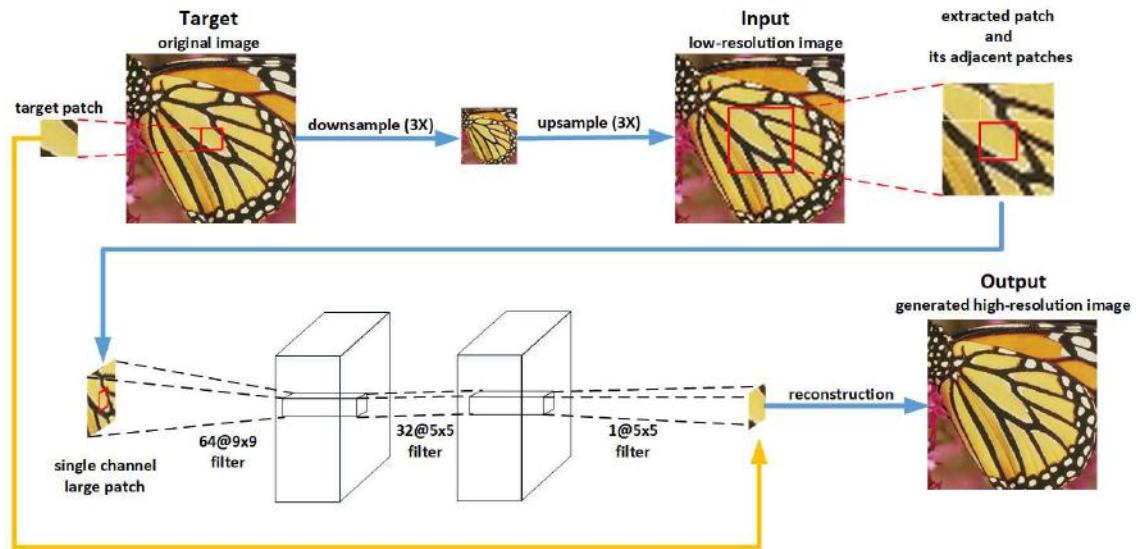
Source Code: <https://github.com/PrathamSoni/CASRCNN>

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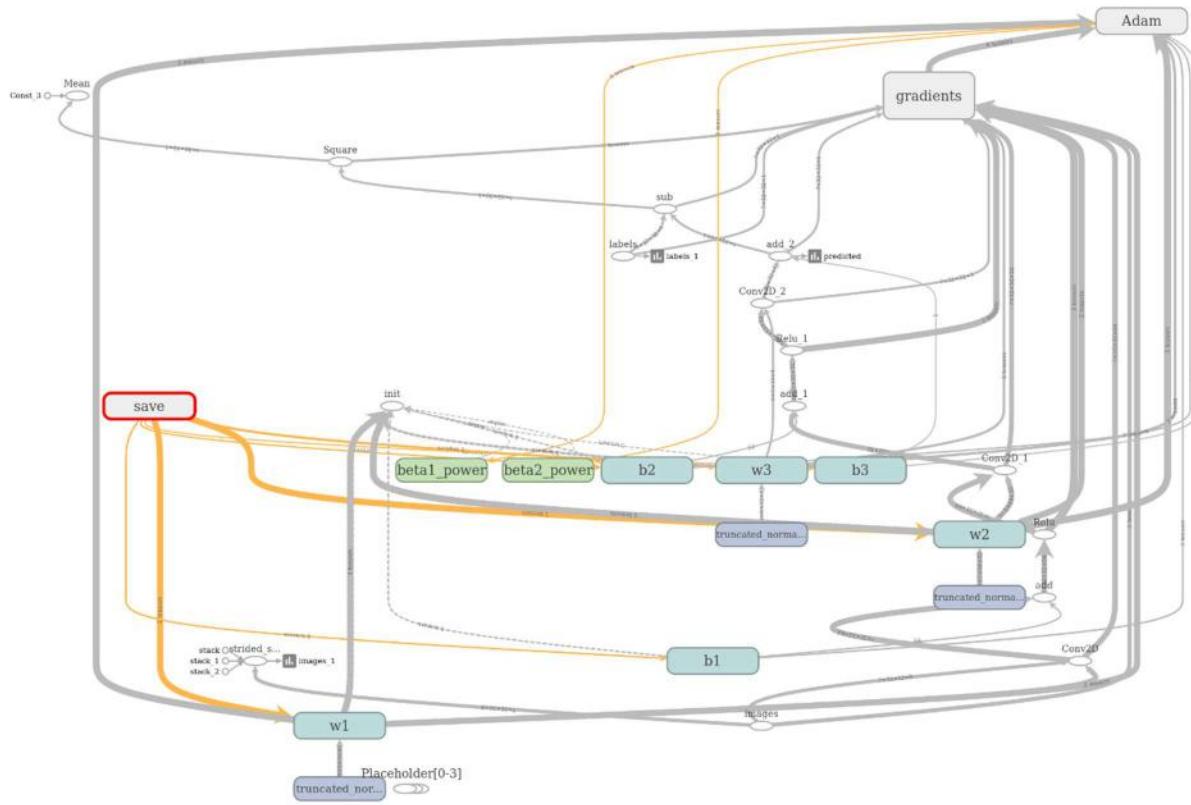
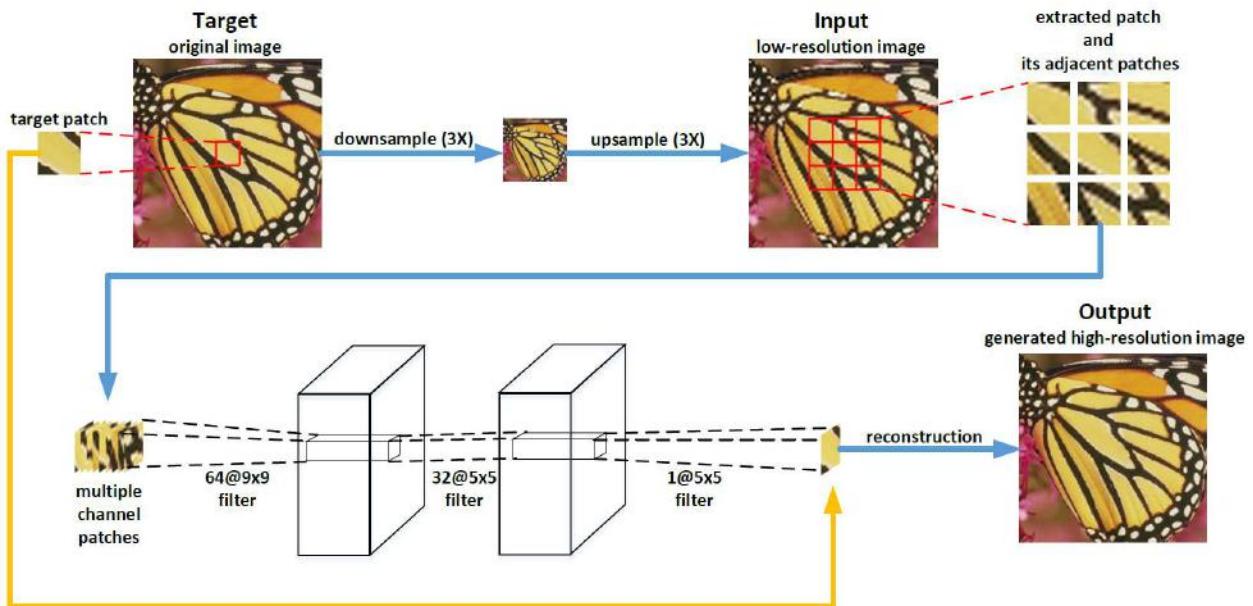
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Architectures

E-SRCNN



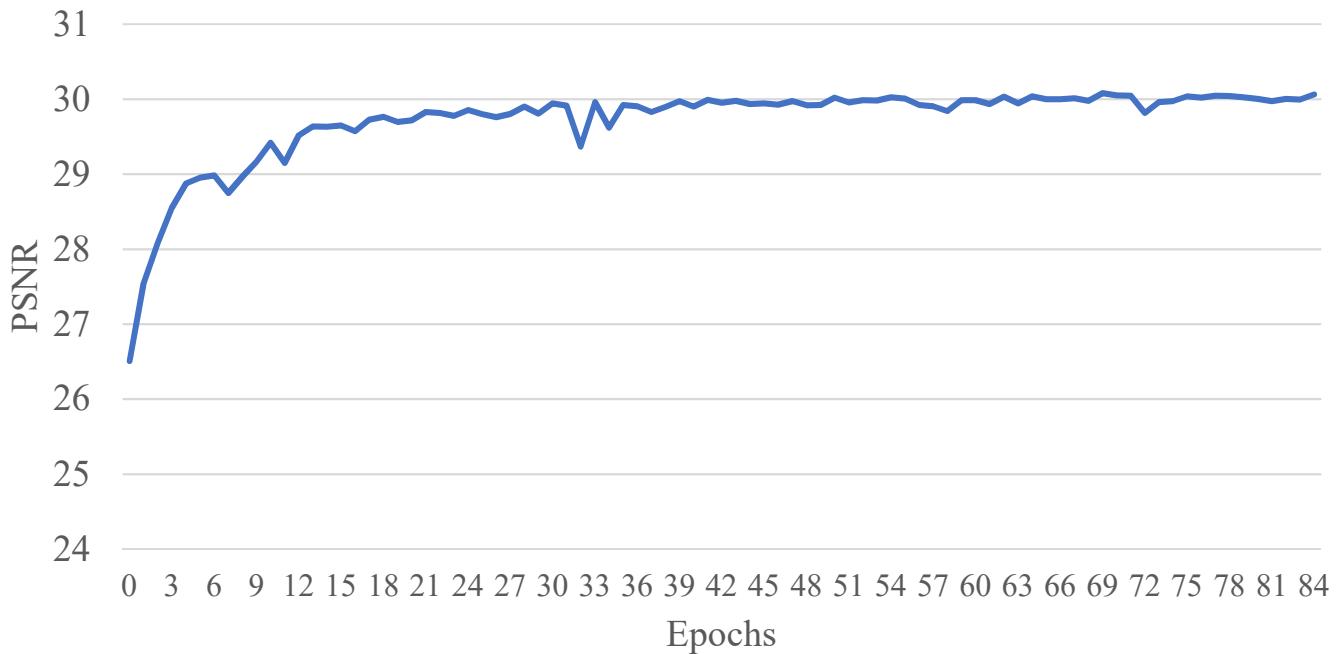
C-SRCNN



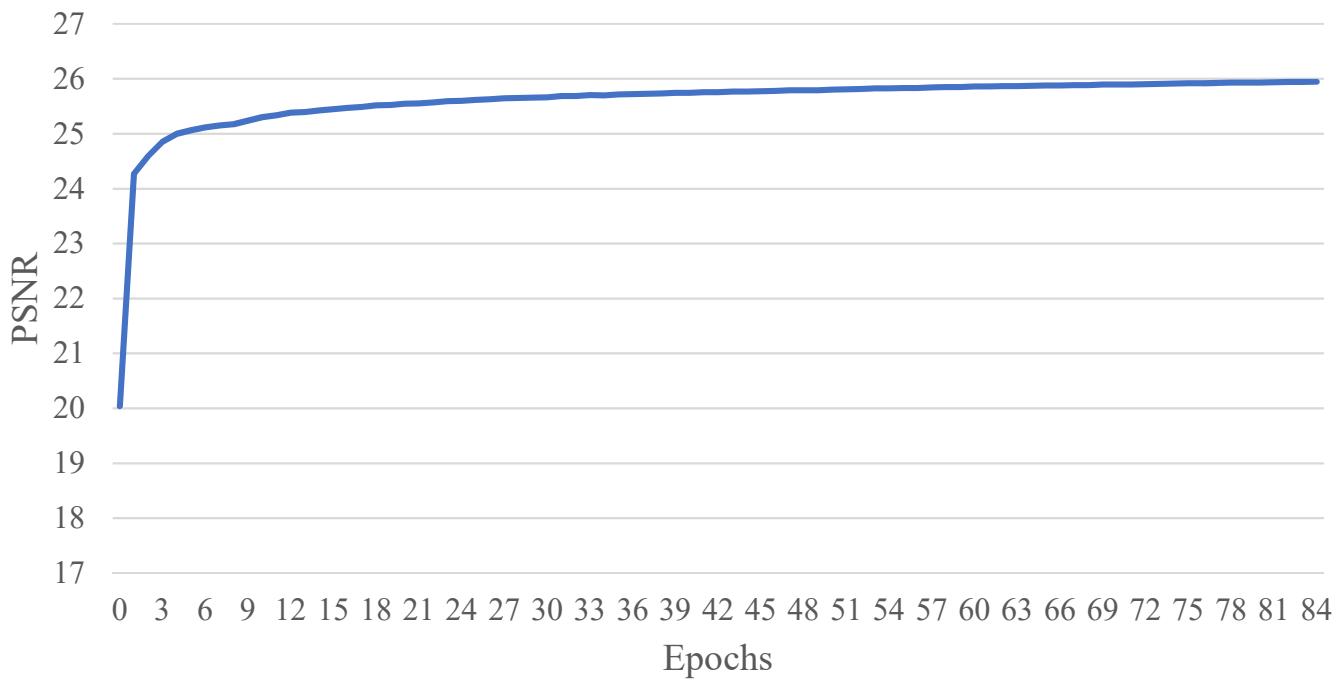
Training

(General 100 Dataset)

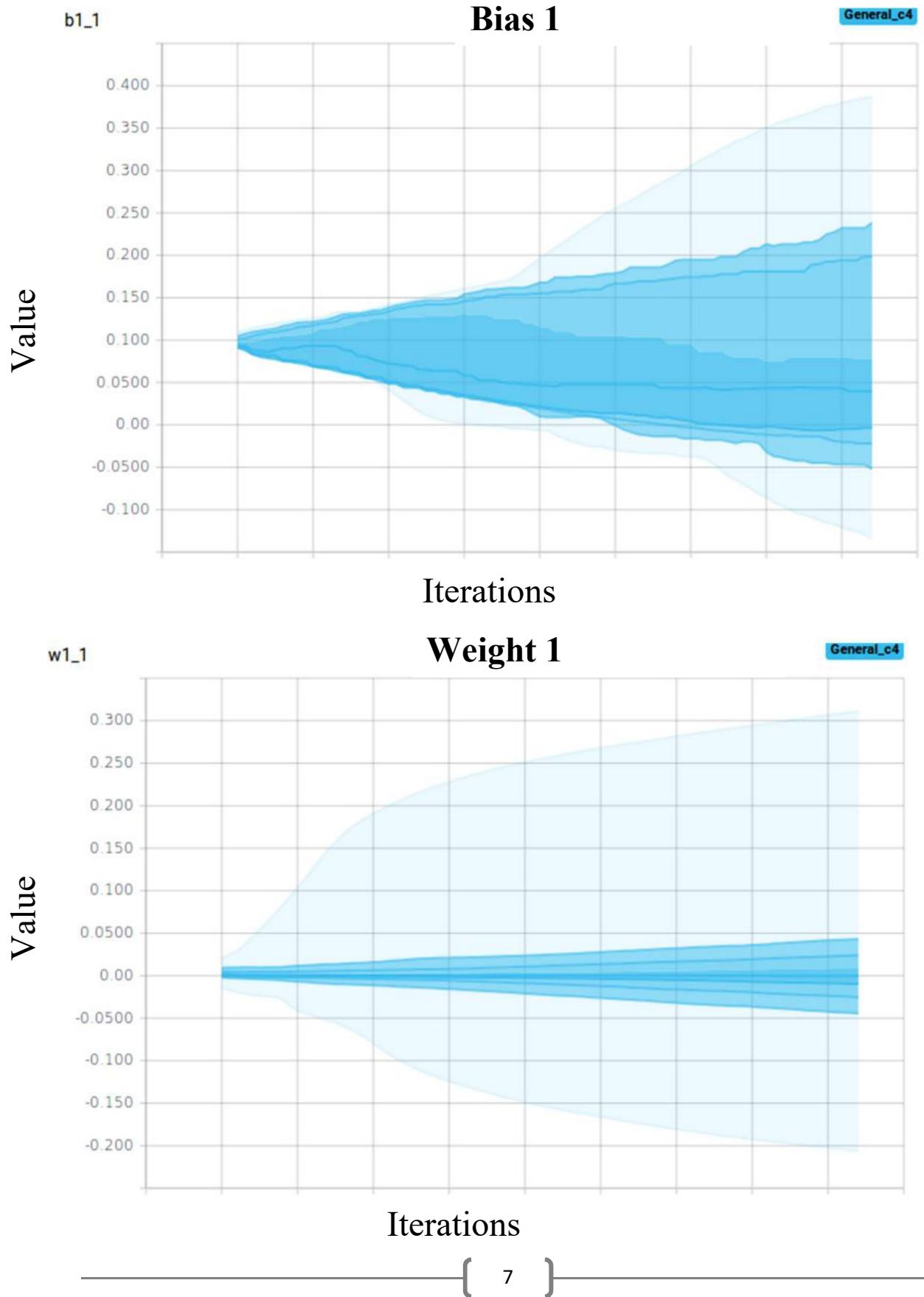
4 Neighbor C-SRCNN Validation Set PSNR on the General100 Dataset

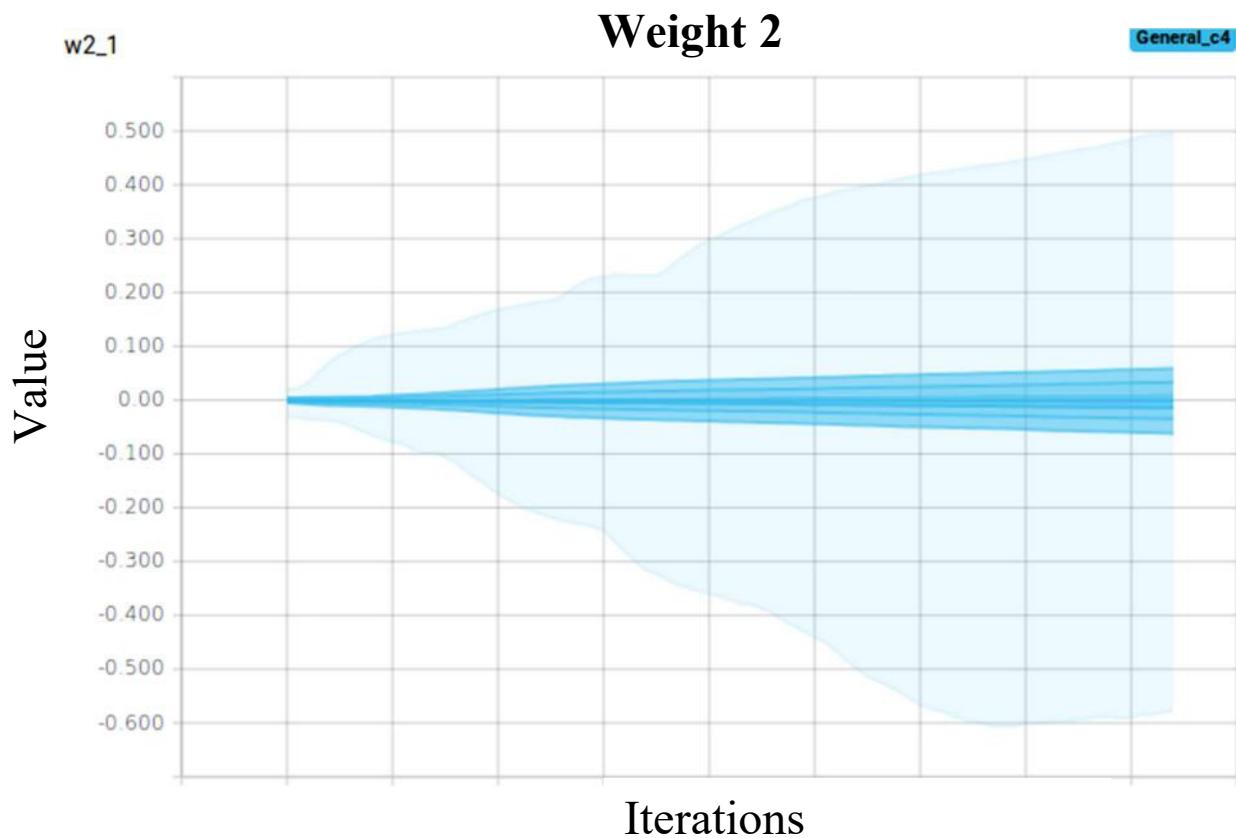
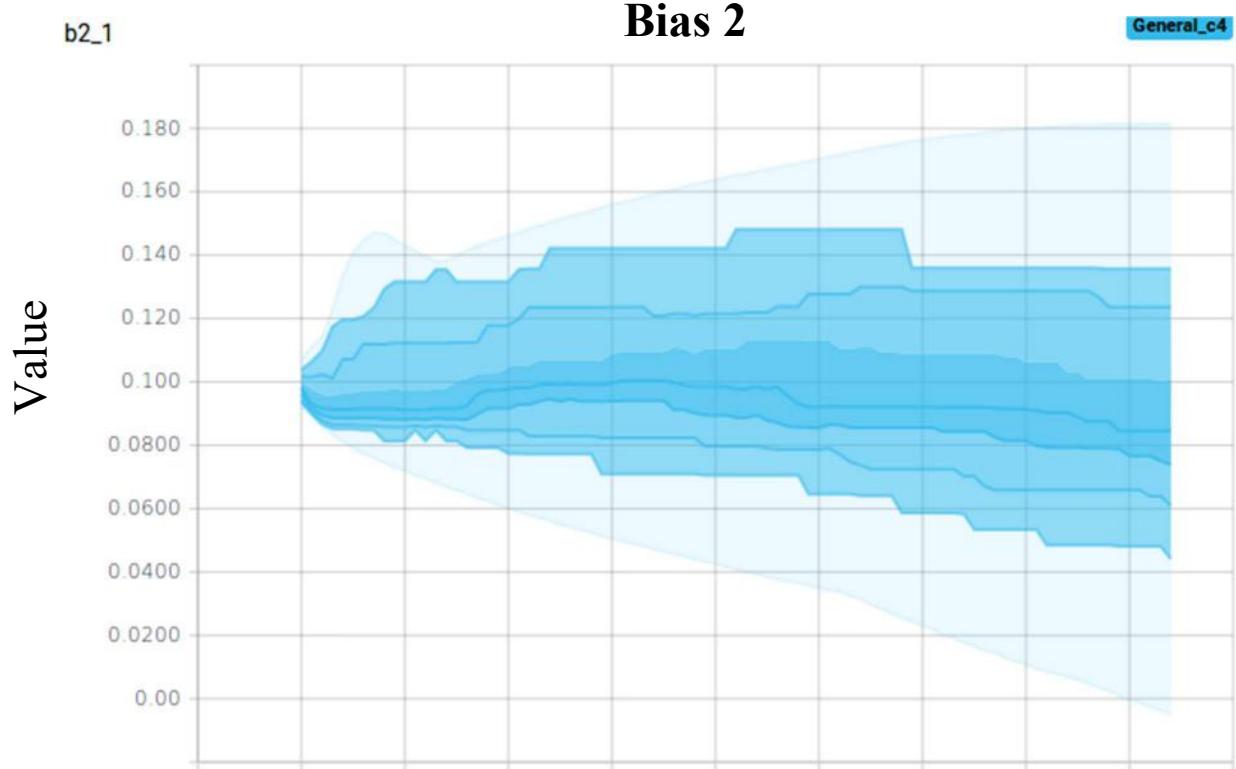


4 Neighbor C-SRCNN Training Set PSNR on the General100 Dataset



Distribution of Biases and Weights for 4 Neighbor C-SRCNN over Epochs (General 100)



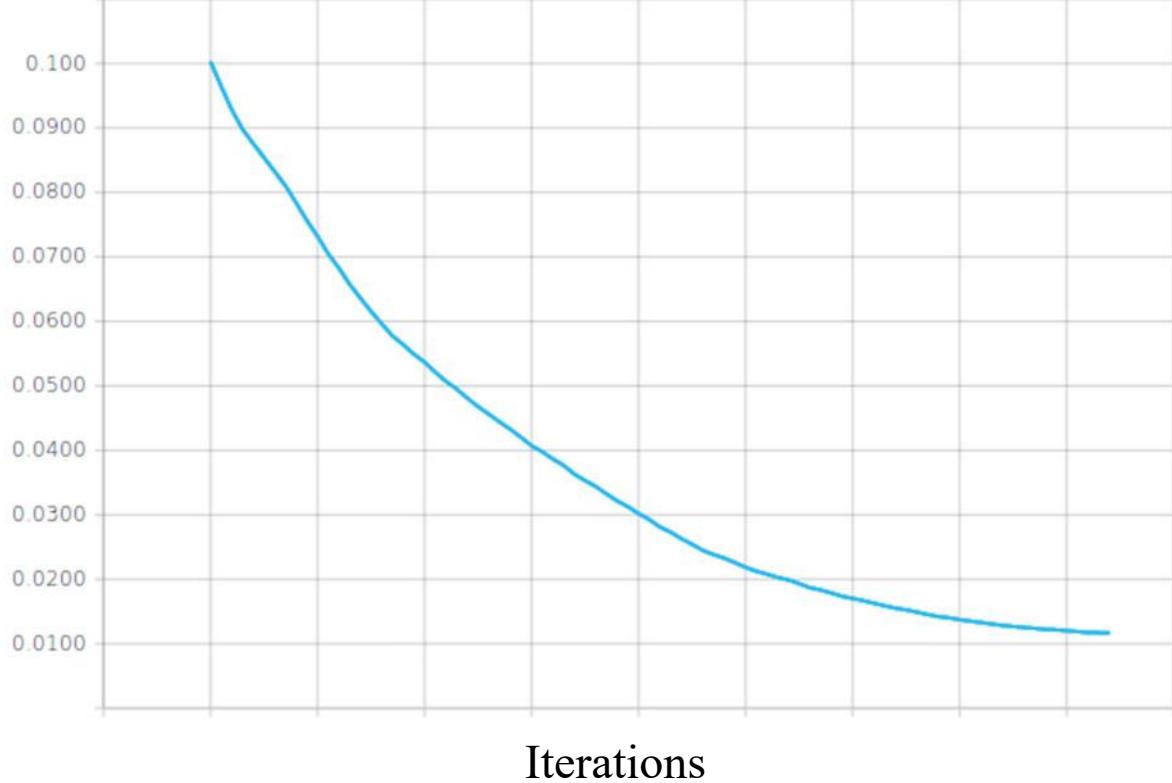


b3_1

Bias 3

General_c4

Value

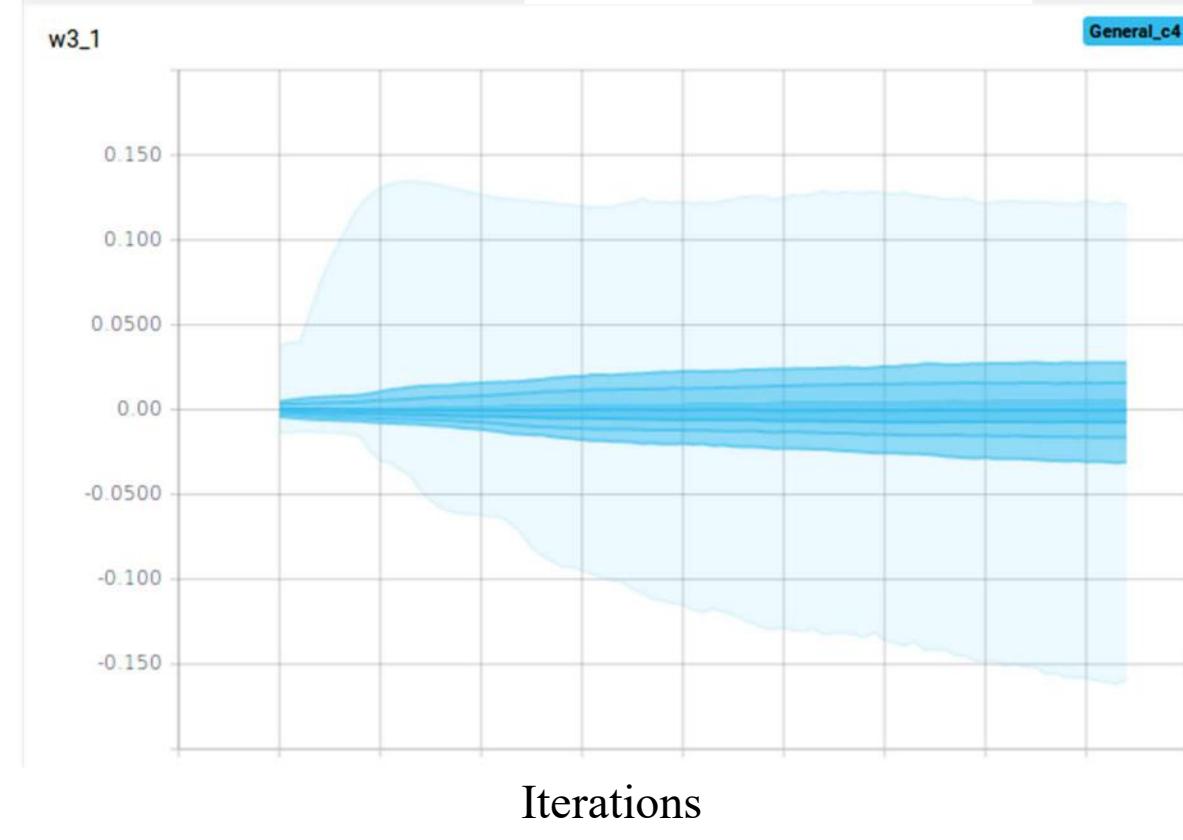


Weight 3

w3_1

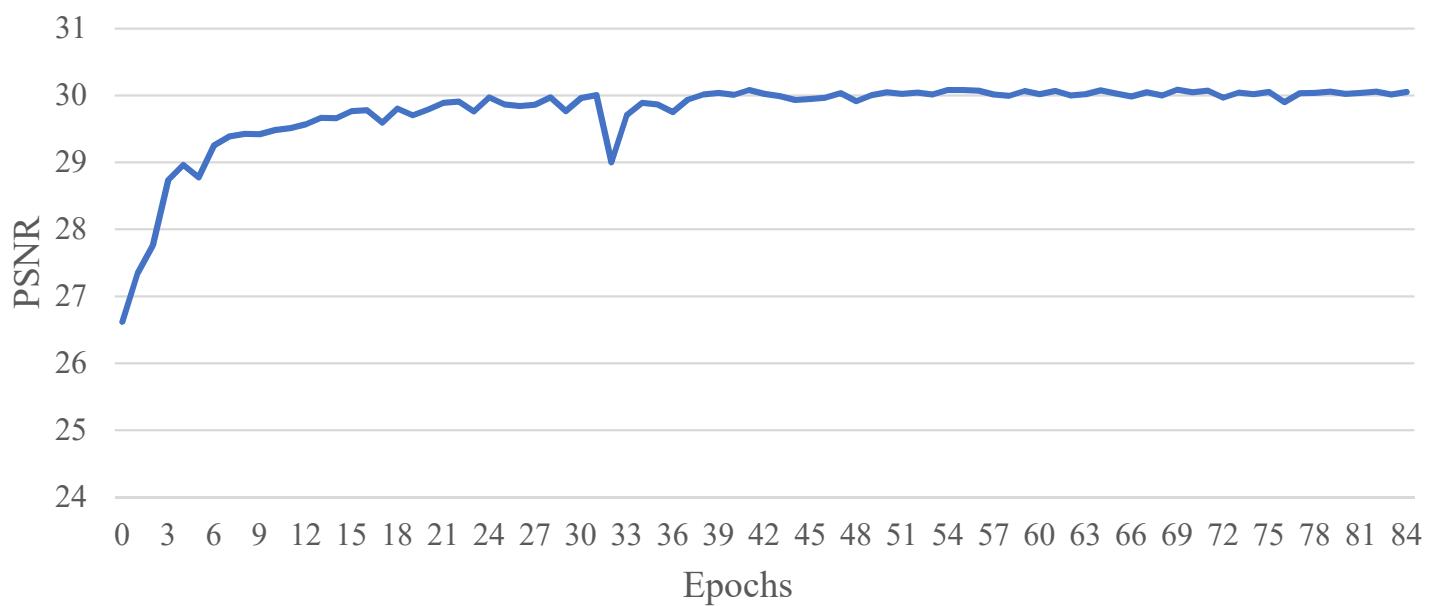
General_c4

Value

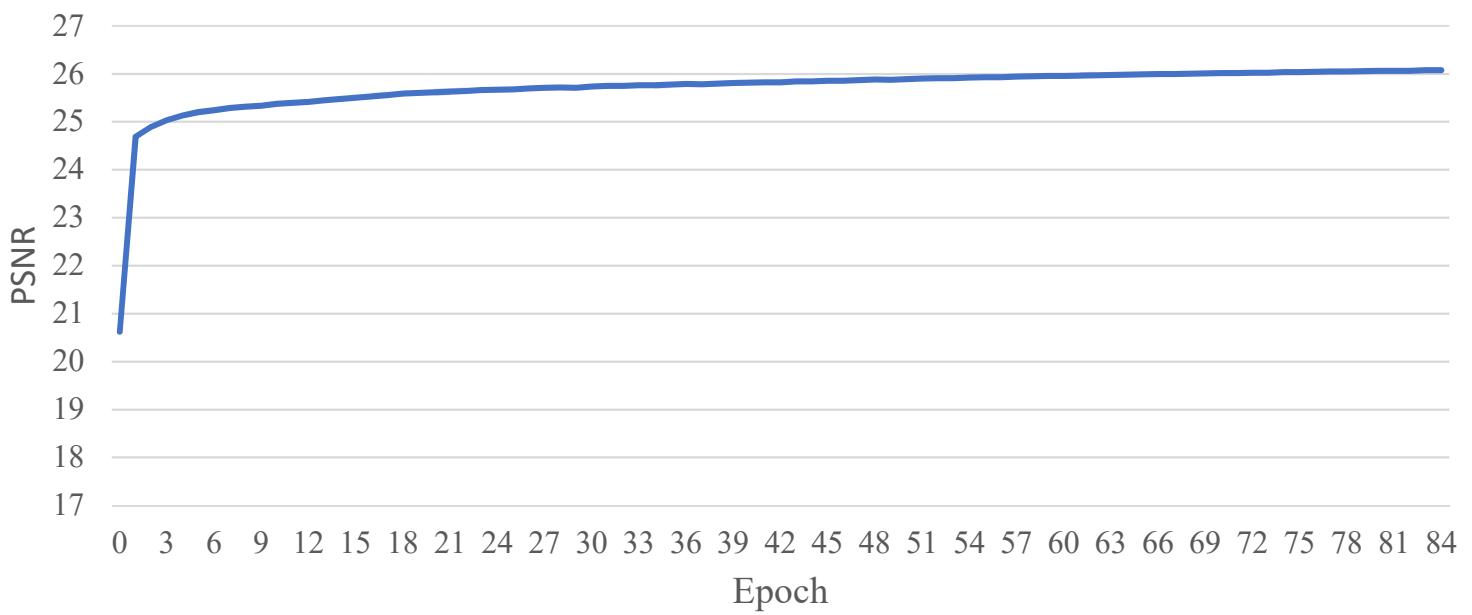


Iterations

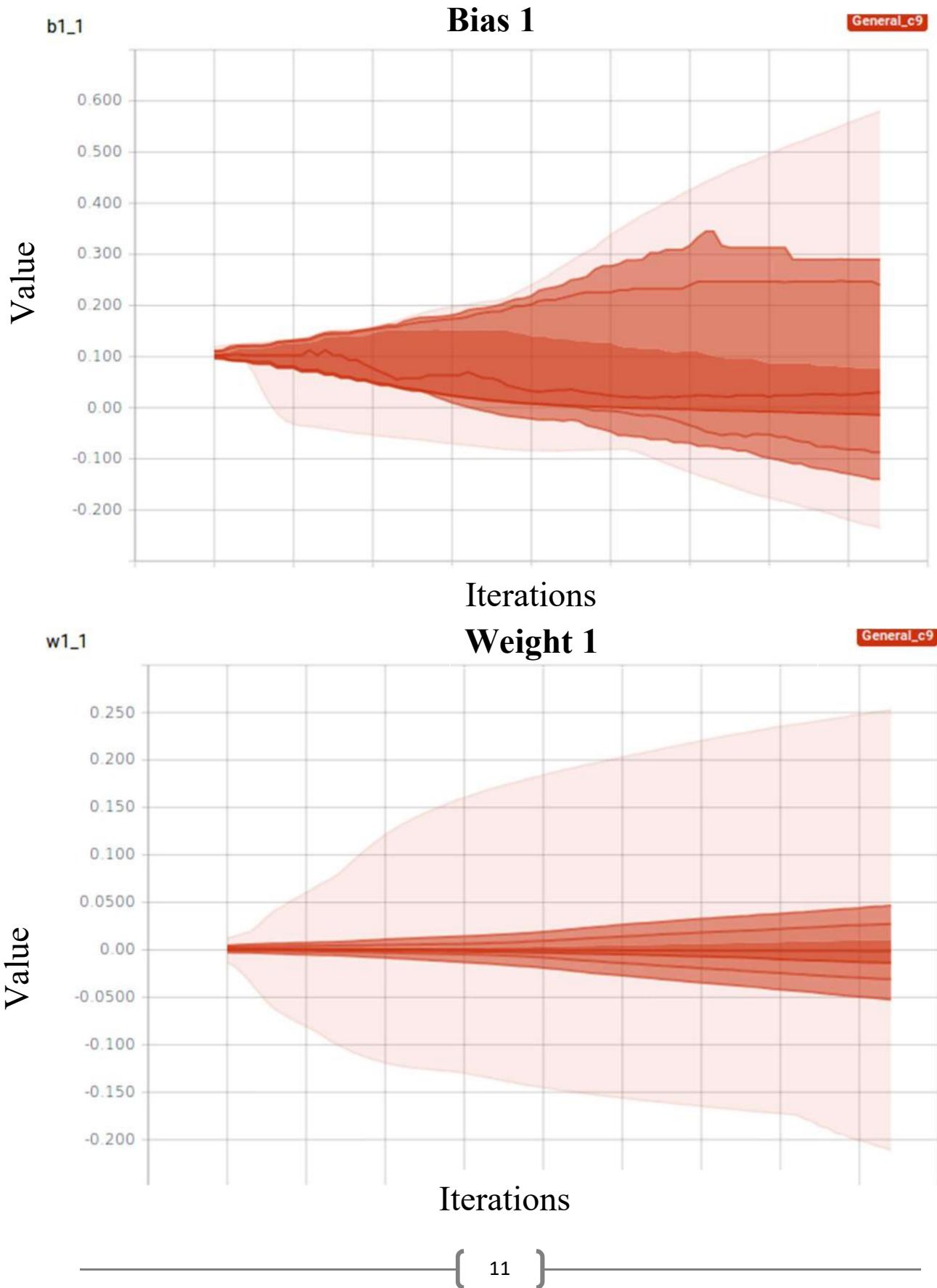
8 Neighbor C-SRCNN Validation Set PSNR on the General100 Dataset

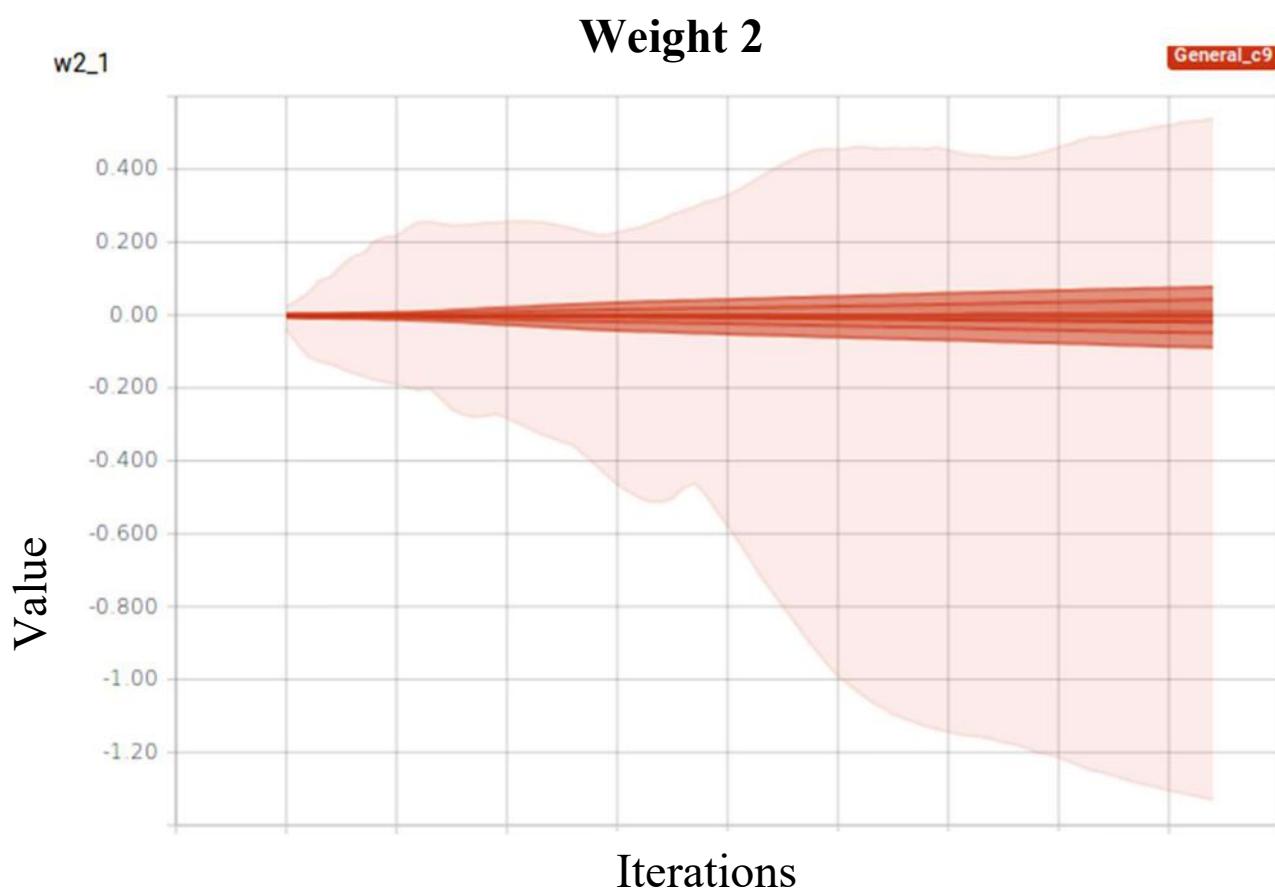
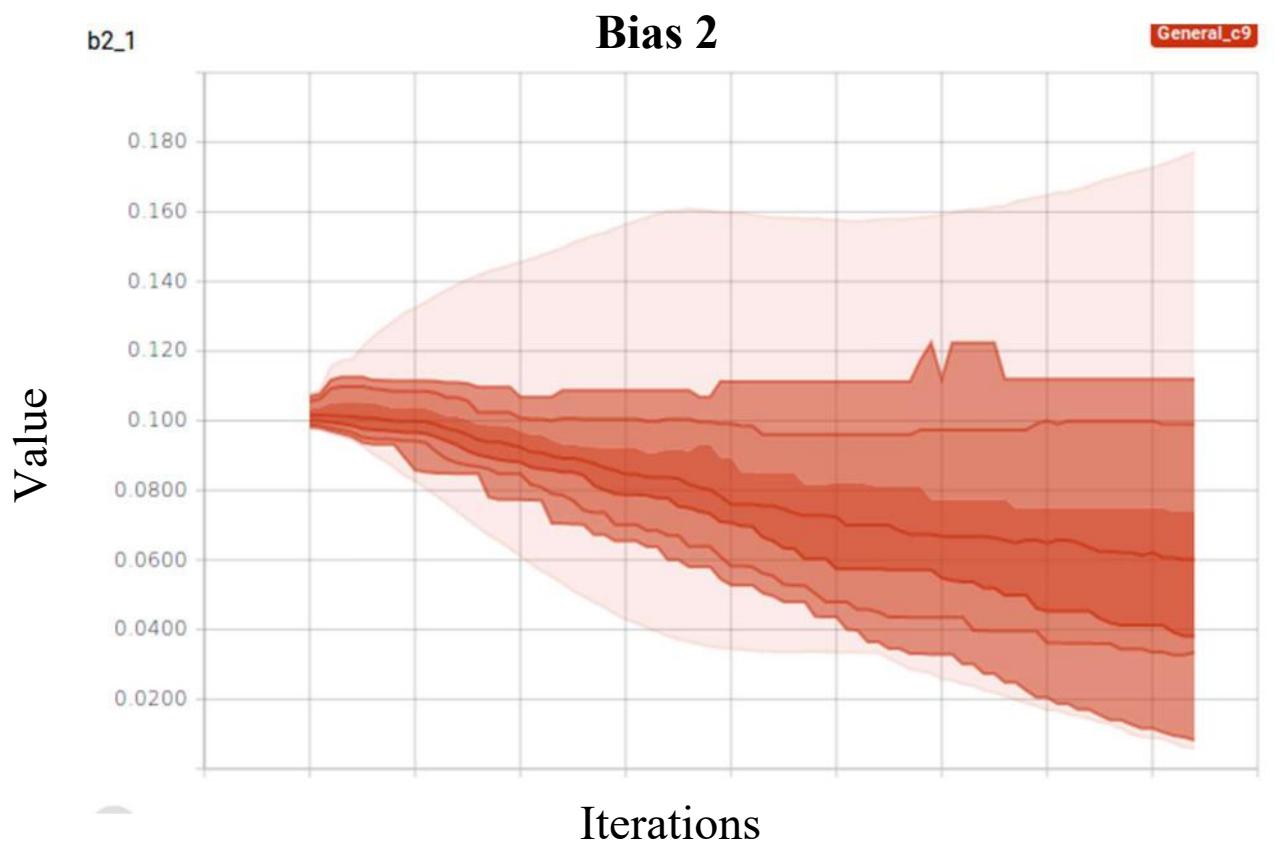


8 Neighbor C-SRCNN Training Set PSNR on the General100 Dataset



Distribution of Biases and Weights for 8 Neighbor C-SRCNN over Epochs (General 100)



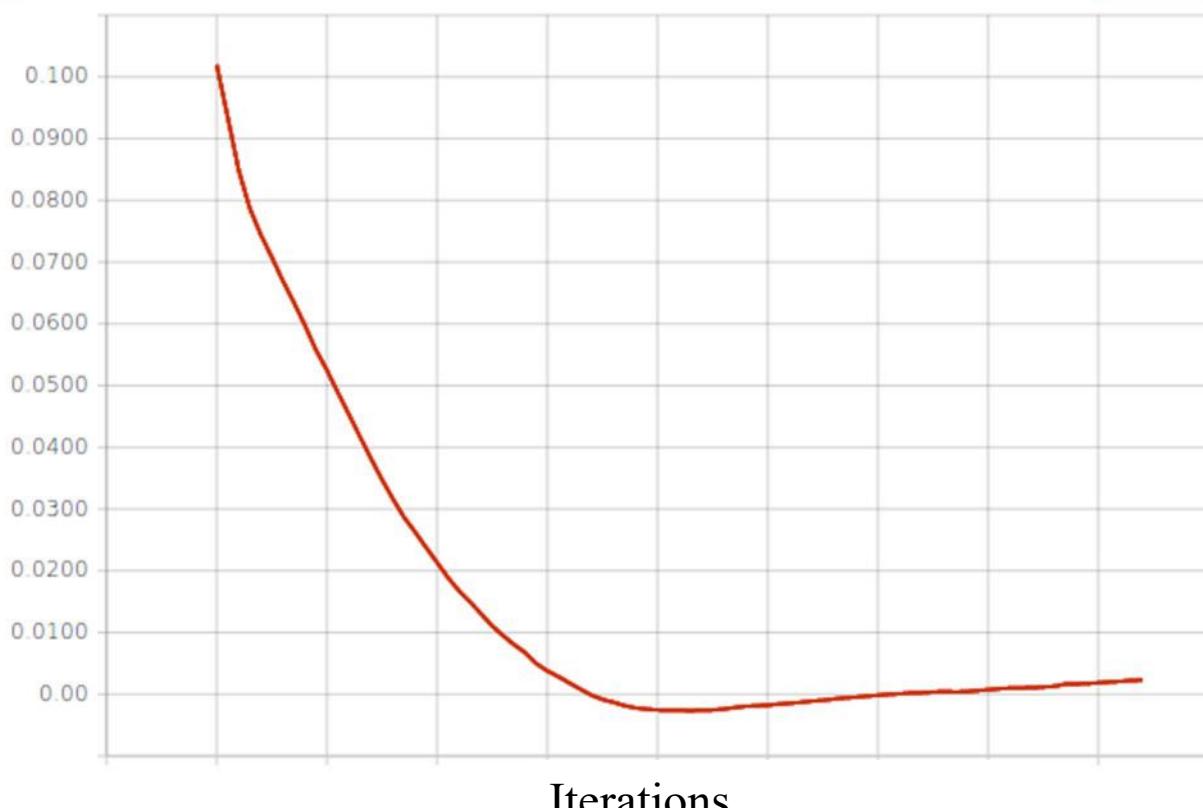


b3_1

Bias 3

General_c9

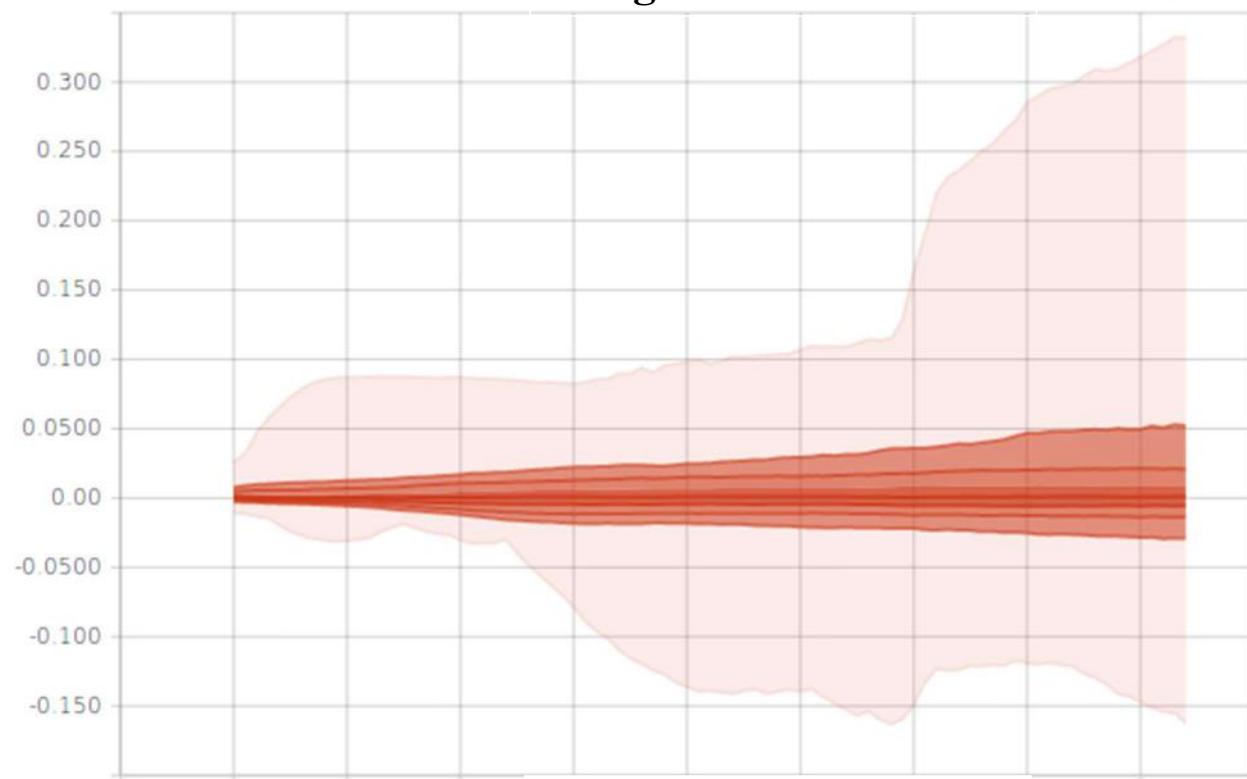
Value



Weight 3

General

Value



Iterations

Testing

(Set 5 Dataset)

Original



PSNR/SSIM

Results for head.bmp

Method	PSNR	SSIM
Nearest Neighbor	27.58	0.6874
Bicubic	29.46	0.7326
SRCNN	31.24	0.8046
Extended Patch	31.12	0.8134
4 Neighbor	31.04	0.7996
8 Neighbor	31.57	0.8049

Nearest Neighbor



27.58/0.6874

Bicubic



29.46/0.7326

SRCNN



31.24/0.8046

E- SRCNN (Ours)



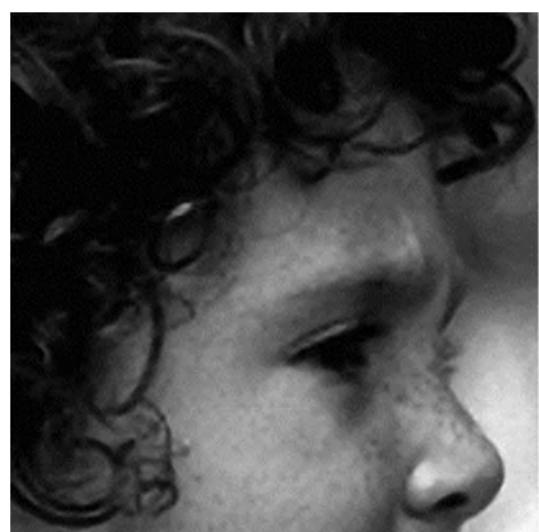
31.12/0.8134

C5 C-SRCNN (Ours)



31.04/0.7996

C9 C-SRCNN (Ours)



31.57/0.8049

Original



PSNR/SSIM

Results for bird.bmp

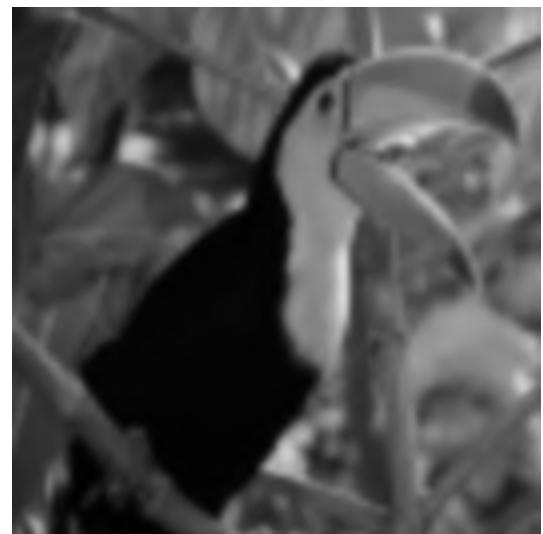
Method	PSNR	SSIM
Nearest Neighbor	25.84	0.8273
Bicubic	28.50	0.8681
SRCNN	31.73	0.9377
Extended Patch	31.50	0.9315
4 Neighbor	32.17	0.9348
8 Neighbor	32.37	0.9396

Nearest Neighbor



25.84/0.8273

Bicubic



28.50/0.8681

SRCNN



31.73/0.9377

E- SRCNN (Ours)



31.50/0.9315

C5 C-SRCNN (Ours)



32.17/0.9348

C9 C-SRCNN (Ours)



32.37/0.9396

Original

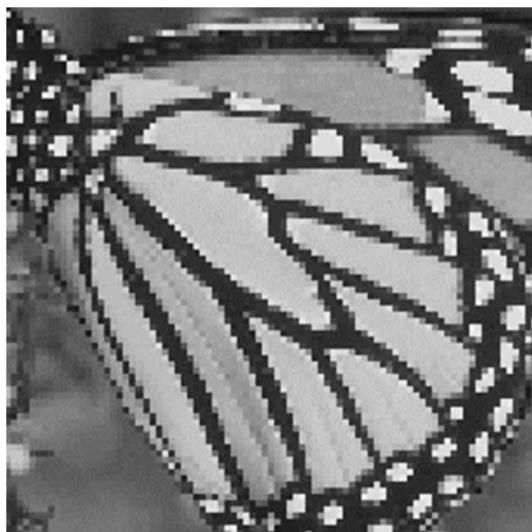


PSNR/SSIM

Results for butterfly.bmp

Method	PSNR	SSIM
Nearest Neighbor	18.31	0.7204
Bicubic	20.36	0.7320
SRCNN	23.90	0.8660
Extended Patch	19.71	0.8337
4 Neighbor	24.24	0.8744
8 Neighbor	24.39	0.8756

Nearest Neighbor



18.31/0.7204

Bicubic



20.36/0.7320

SRCNN



23.90/0.8660

E- SRCNN (Ours)



19.71/0.8337

C5 C-SRCNN (Ours)



24.24/0.8744

C9 C-SRCNN (Ours)



24.39/0.8756

Original



PSNR/SSIM

Results for baby.bmp

Method	PSNR	SSIM
Nearest Neighbor	28.59	0.8479
Bicubic	29.26	0.8273
SRCCN	32.74	0.9080
Extended Patch	32.22	0.9053
4 Neighbor	32.70	0.9055
8 Neighbor	32.68	0.9043

Nearest Neighbor



28.59/0.8479

Bicubic



29.26/0.8273

SRCNN



32.74/0.9080

E- SRCNN (Ours)



32.22/0.9053

C5 C-SRCNN (Ours)



32.70/0.9055

C9 C-SRCNN (Ours)

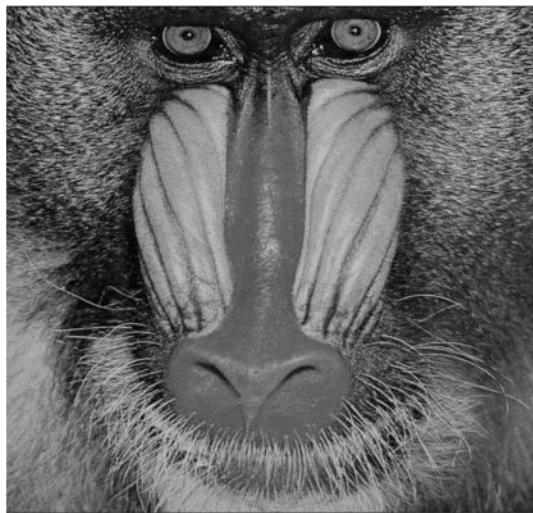


32.68/0.9043

Testing

(Set 14 Dataset)

Original

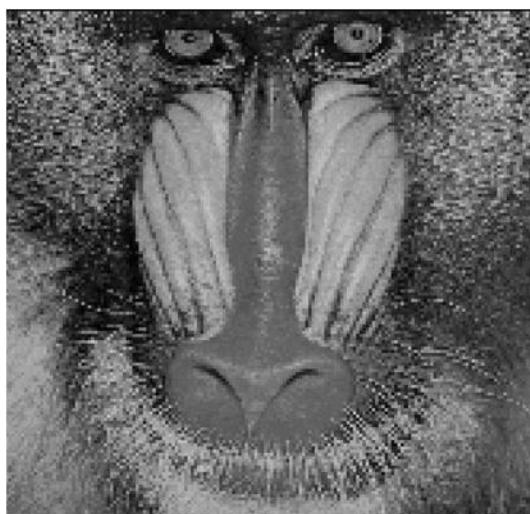


Results for baboon.bmp

Method	PSNR	SSIM
Nearest Neighbor	19.35	0.4844
Bicubic	20.87	0.4538
SRCNN	17.07	0.5849
Extended Patch	17.16	0.5066
4 Neighbor	16.34	0.5827
8 Neighbor	17.00	0.5856

PSNR/SSIM

Nearest Neighbor



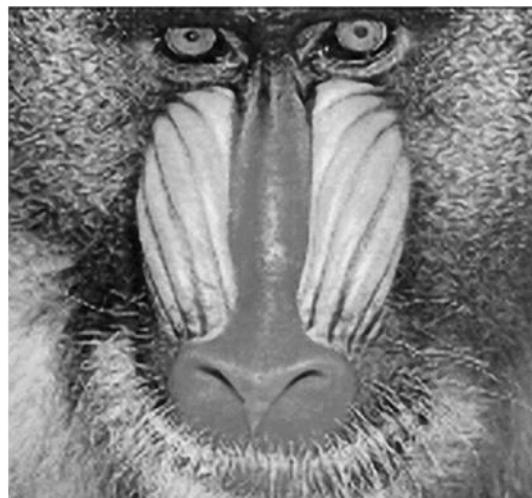
19.35/0.4844

Bicubic



20.87/0.4538

SRCNN



17.07/0.5849

E- SRCNN (Ours)



17.16/0.5066

C5 C-SRCNN (Ours)



16.34/0.5827

C9 C-SRCNN (Ours)



17.00/**0.5856**

Original



Results for barbara.bmp

Method	PSNR	SSIM
Nearest Neighbor	22.26	0.6978
Bicubic	23.66	0.6807
SRCCN	23.62	0.7623
Extended Patch	23.17	0.7379
4 Neighbor	23.58	0.7598
8 Neighbor	23.40	0.7597

PSNR/SSIM

Nearest Neighbor



22.26/0.6978

Bicubic



23.66/0.6807

SRCCNN



23.62/0.7623

E- SRCCNN (Ours)



23.170.7379

C5 C-SRCCNN (Ours)



23.58/0.7598

C9 C-SRCCNN (Ours)



23.40/0.7597

Original



PSNR/SSIM

Results for bridge.bmp

Method	PSNR	SSIM
Nearest Neighbor	21.10	0.5874
Bicubic	22.88	0.5676
SRCNN	24.16	0.7073
Extended Patch	22.32	0.7041
4 Neighbor	24.24	0.7071
8 Neighbor	24.07	0.7069

Nearest Neighbor



21.10/0.5874

Bicubic



22.88/0.5676

SRCNN



24.16/**0.7073**

E- SRCNN (Ours)



22.32/0.7041

C5 C-SRCNN (Ours)



24.24/0.7071

C9 C-SRCNN (Ours)



24.07/0.7069

Original



PSNR/SSIM

Results for coastguard.bmp

Method	PSNR	SSIM
Nearest Neighbor	22.71	0.5874
Bicubic	23.93	0.5168
SRCNN	24.78	0.6262
Extended Patch	22.41	0.6199
4 Neighbor	24.83	0.6264
8 Neighbor	24.80	0.6267

Nearest Neighbor



22.71/0.5874

Bicubic



23.93/0.5168

SRCNN



E- SRCNN (Ours)



24.78/0.6262

22.41/0.6199

C5 C-SRCNN (Ours)



C9 C-SRCNN (Ours)



24.83/0.6264

0.2480/**0.6267**

Original



Results for comic.bmp

Method	PSNR	SSIM
Nearest Neighbor	18.26	0.6117
Bicubic	20.01	0.5908
SRCNN	21.84	0.7643
Extended Patch	18.26	0.7065
4 Neighbor	21.92	0.7670
8 Neighbor	21.87	0.7671

PSNR/SSIM

Nearest Neighbor



18.26/0.6117

Bicubic



20.01/0.5908

SRCNN



21.84/0.7643

E- SRCNN (Ours)



18.26/0.7065

C5 C-SRCNN (Ours)



21.92/0.7670

C9 C-SRCNN (Ours)



21.87/0.7671

Original



Results for flowers.bmp

PSNR/SSIM

Method	PSNR	SSIM
Nearest Neighbor	22.26	0.7067
Bicubic	23.54	0.7058
SRCNN	26.51	0.8271
Extended Patch	21.24	0.7817
4 Neighbor	26.56	0.8280
8 Neighbor	26.57	0.8292

Nearest Neighbor



Bicubic



22.26/0.7076

23.54/0.7058

SRCNN



E- SRCNN (Ours)



26.51/0.8271

21.24/0.7817

C5 C-SRCNN (Ours)



C9 C-SRCNN (Ours)



26.56/0.8280

26.57/0.8292

Original



PSNR/SSIM

Results for foreman.bmp

Method	PSNR	SSIM
Nearest Neighbor	25.36	0.8276
Bicubic	26.81	0.8547
SRCNN	30.28	0.9130
Extended Patch	23.06	0.9013
4 Neighbor	30.17	0.9136
8 Neighbor	30.76	0.9129

Nearest Neighbor



25.36/0.8273

Bicubic



26.81/0.8547

SRCNN



30.28/0.9130

E- SRCNN (Ours)



23.06/0.9013

C5 C-SRCNN (Ours)



30.17/0.9136

C9 C-SRCNN (Ours)



30.76/0.9129

Original



PSNR/SSIM

Results for lenna.bmp

Method	PSNR	SSIM
Nearest Neighbor	25.90	0.7521
Bicubic	27.57	0.7878
SRCCNN	28.02	0.8587
Extended Patch	26.10	0.8460
4 Neighbor	27.38	0.8592
8 Neighbor	26.94	0.8574

Nearest Neighbor



25.90/0.7521

Bicubic



27.57/0.7878

SRCNN



28.02/0.8587

E- SRCNN (Ours)



26.10/0.8460

C5 C-SRCNN (Ours)



27.38/**0.8592**

C9 C-SRCNN (Ours)



26.94/0.8574

Original



Results for man.bmp

Method	PSNR	SSIM
Nearest Neighbor	22.13	0.6358
Bicubic	23.86	0.6569
SRCNN	25.75	0.7728
Extended Patch	23.31	0.7086
4 Neighbor	25.84	0.7721
8 Neighbor	26.02	0.7731

PSNR/SSIM

Nearest Neighbor



22.13/0.6358

Bicubic



23.86/0.6569

SRCNN



25.75/0.7728

E- SRCNN (Ours)



23.31/0.7086

C5 C-SRCNN (Ours)



25.84/0.7721

C9 C-SRCNN (Ours)



26.02/0.7731

Original

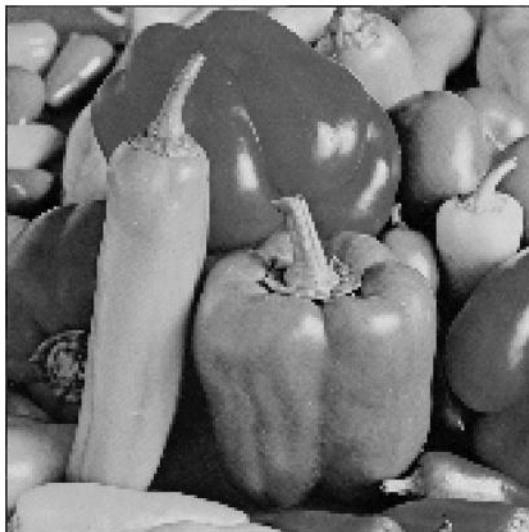


PSNR/SSIM

Results for pepper.bmp

Method	PSNR	SSIM
Nearest Neighbor	25.10	0.7649
Bicubic	27.35	0.8099
SRCNN	23.51	0.8554
Extended Patch	23.34	0.8541
4 Neighbor	24.21	0.8556
8 Neighbor	25.19	0.8570

Nearest Neighbor



2510/0.7649

Bicubic



27.35/0.8099

SRCNN



23.51/0.8554

E- SRCNN (Ours)



23.34/0.8541

C5 C-SRCNN (Ours)



24.21/0.8556

C9 C-SRCNN (Ours)



25.19/**0.8570**

Original



Results for monarch.bmp

Method	PSNR	SSIM
Nearest Neighbor	24.01	0.8529
Bicubic	25.47	0.8740
SRCNN	28.16	0.9285
Extended Patch	20.64	0.8932
4 Neighbor	26.19	0.9245
8 Neighbor	29.09	0.9308

PSNR/SSIM

Nearest Neighbor



Bicubic



24.01/0.8529

25.47/0.8740

SRCNN



E- SRCNN (Ours)



28.16/0.9285

20.64/0.8932

C5 C-SRCNN (Ours)



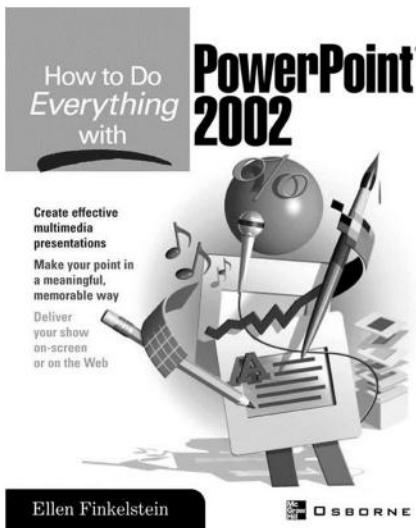
C9 C-SRCNN (Ours)



26.19/0.9245

29.09/0.9308

Original

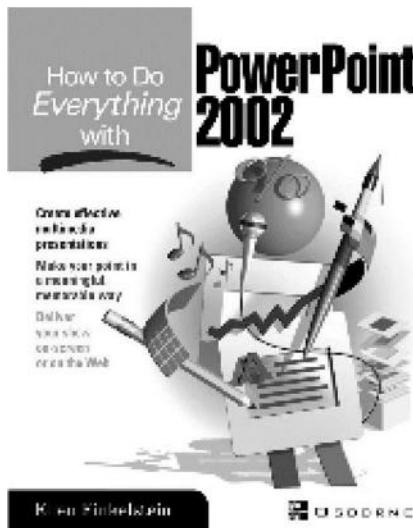


PSNR/SSIM

Results for ppt3.bmp

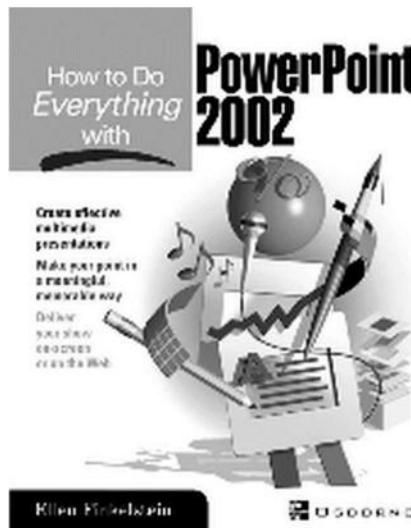
Method	PSNR	SSIM
Nearest Neighbor	18.84	0.8367
Bicubic	20.29	0.8141
SRCNN	22.98	0.8893
Extended Patch	12.74	0.8093
4 Neighbor	23.12	0.8954
8 Neighbor	23.14	0.8906

Nearest Neighbor



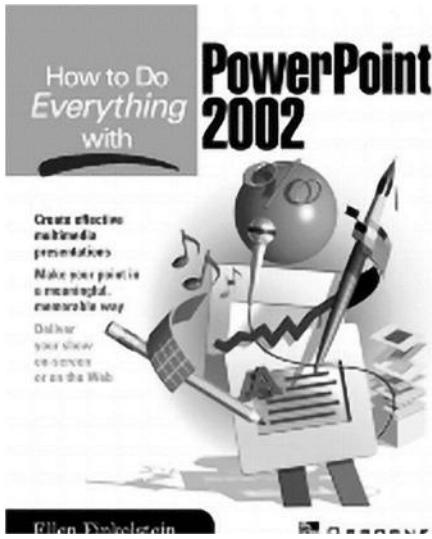
18.84/0.8367

Bicubic



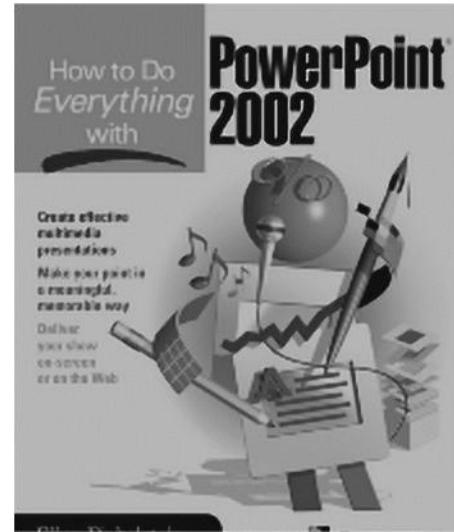
20.29/0.8141

SRCNN



22.98/0.8893

E- SRCNN (Ours)



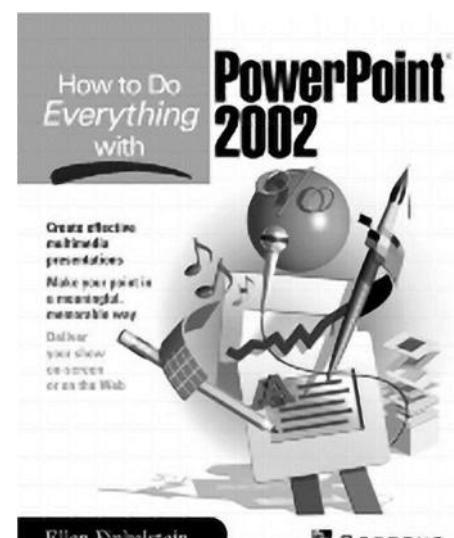
12.74/0.8093

C5 C-SRCNN (Ours)



23.12/**0.8954**

C9 C-SRCNN (Ours)



23.14/0.8906

Original

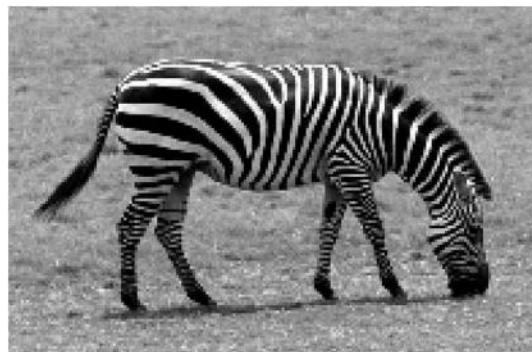


Results for zebra.bmp

Method	PSNR	SSIM
Nearest Neighbor	20.48	0.6705
Bicubic	21.75	0.6704
SRCCNN	26.37	0.8357
Extended Patch	23.46	0.7937
4 Neighbor	26.45	0.8372
8 Neighbor	26.30	0.8356

PSNR/SSIM

Nearest Neighbor



Bicubic



20.48/0.6705

21.75/0.6704

SRCNN



E- SRCNN (Ours)



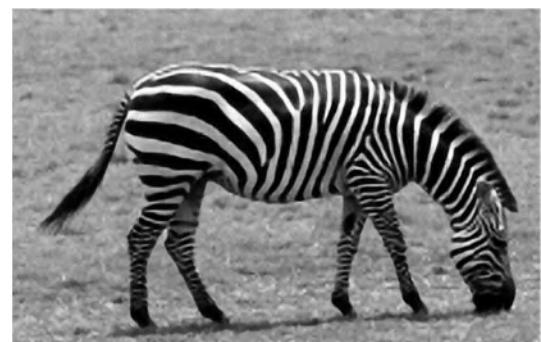
26.37/0.8357

23.46/0.7937

C5 C-SRCNN (Ours)



C9 C-SRCNN (Ours)

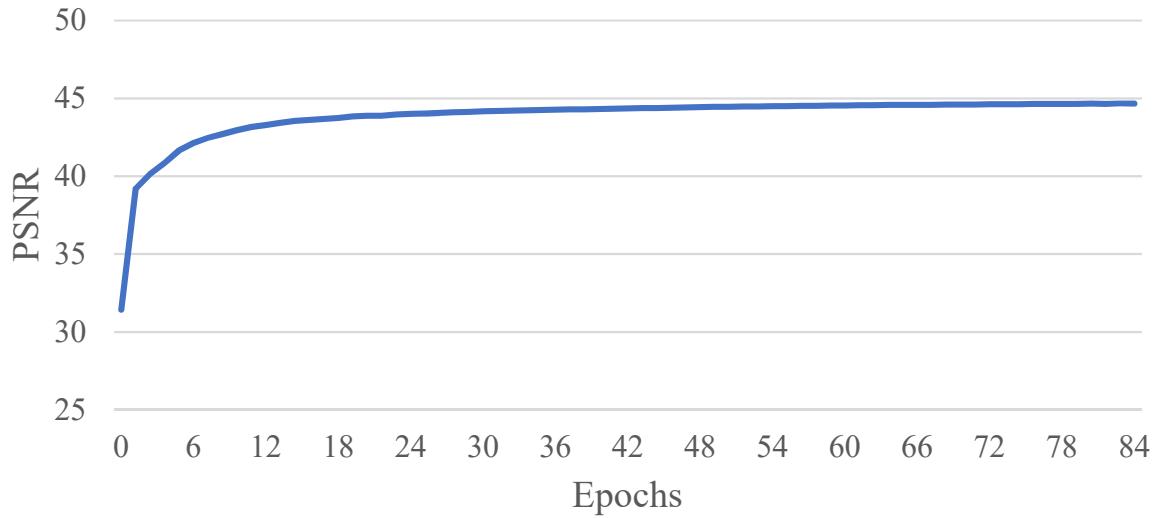


26.45/0.8372

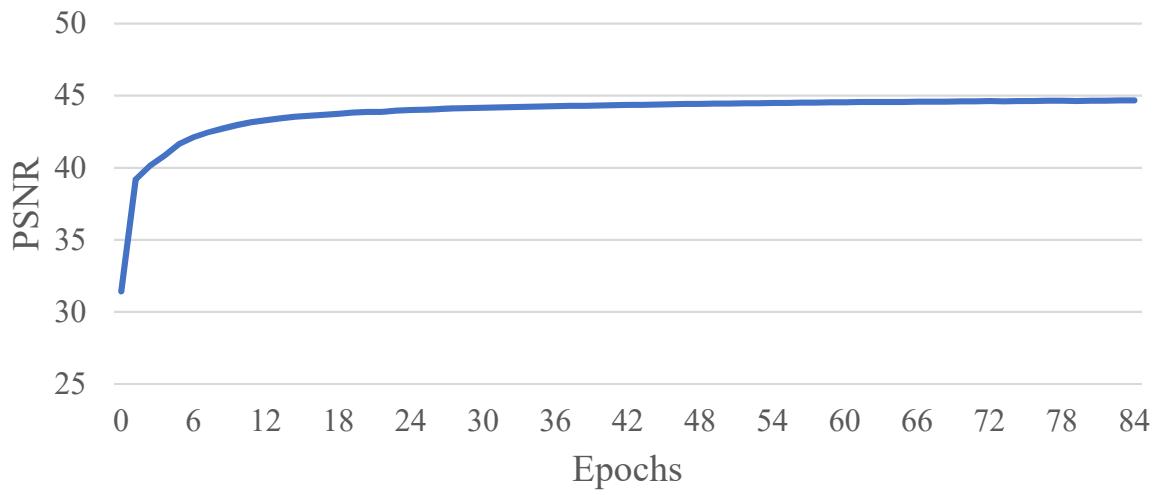
26.30/0.8356

Training (Medical Images) (DICOM Library)

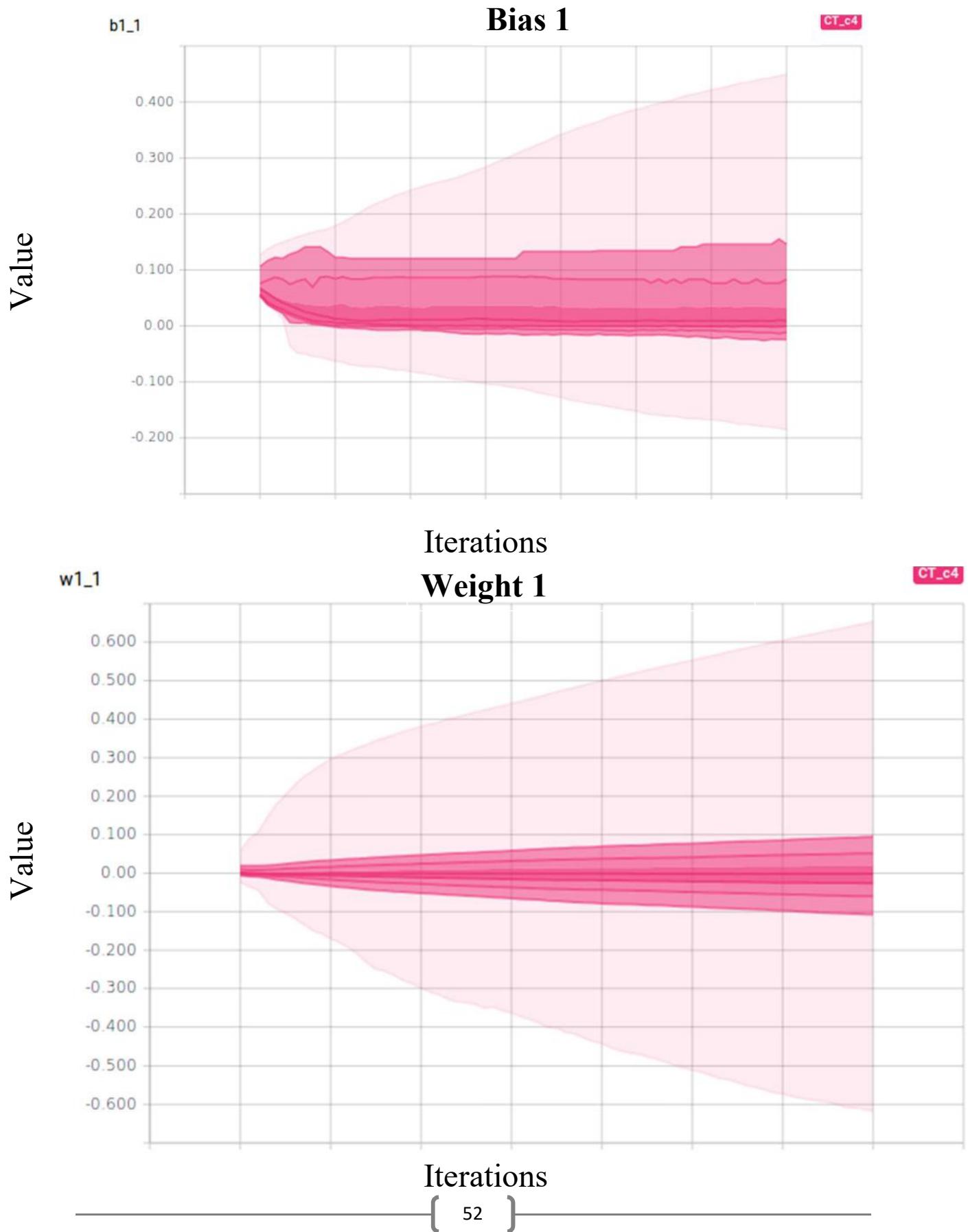
4 Neighbor C-SRCNN Validation Set PSNR on Medical Images

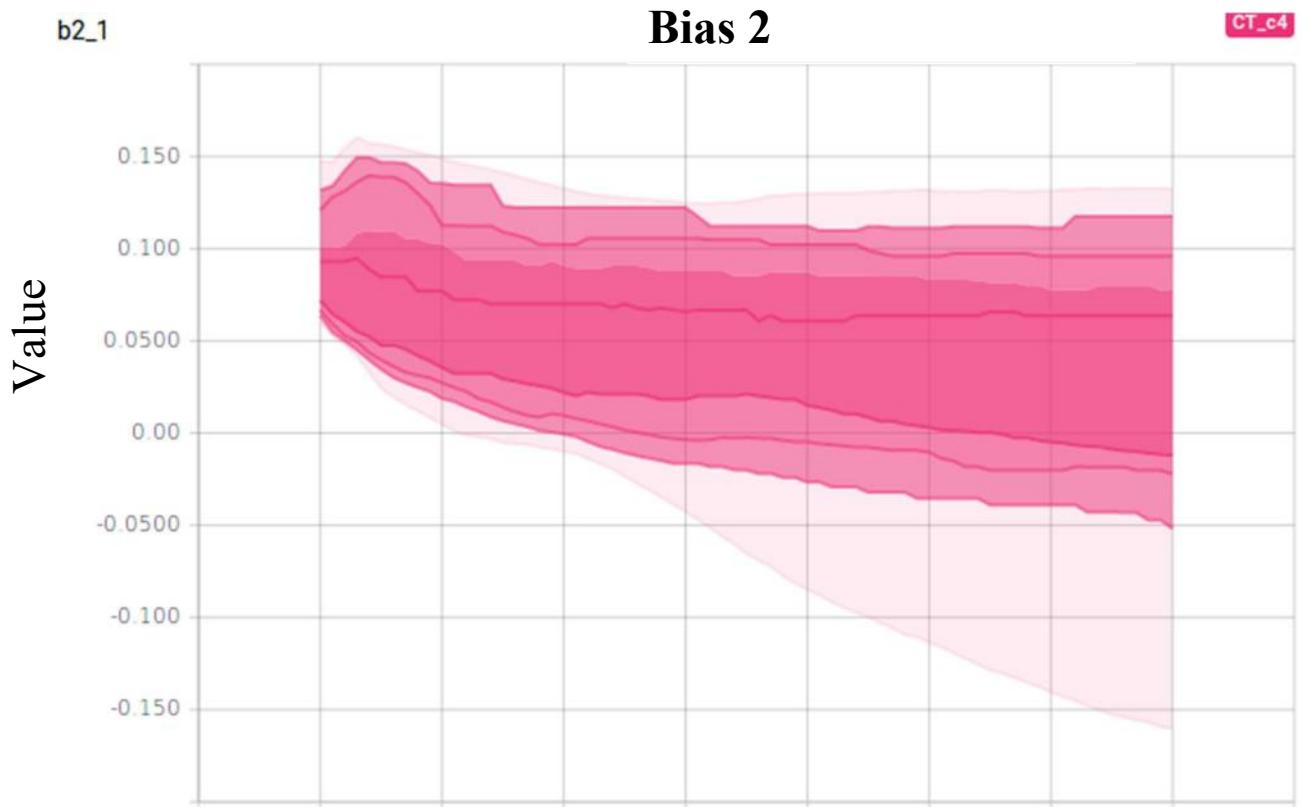


4 Neighbor C-SRCNN Training Set PSNR on Medical Images

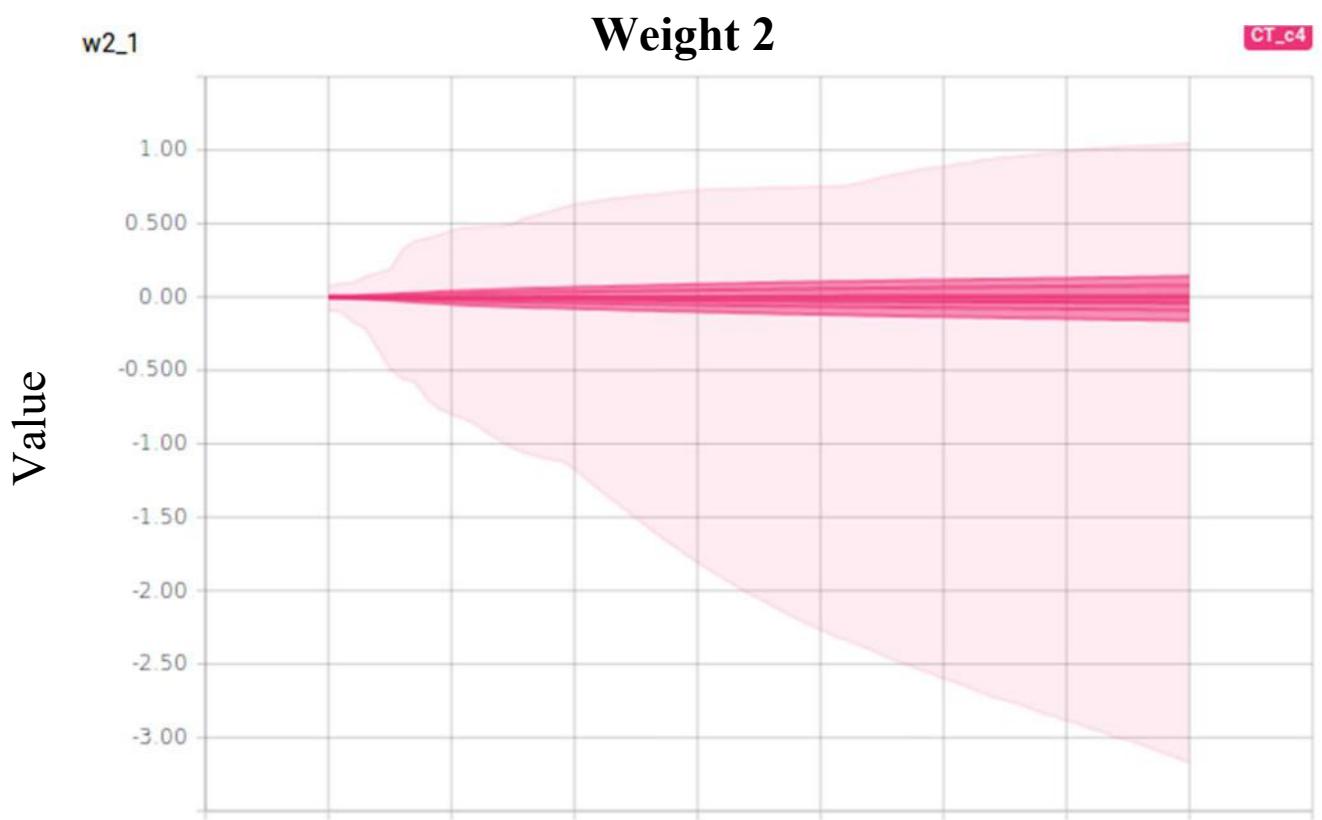


Distribution of Biases and Weights for 4 Neighbor C-SRCNN over Epochs (Medical Images)

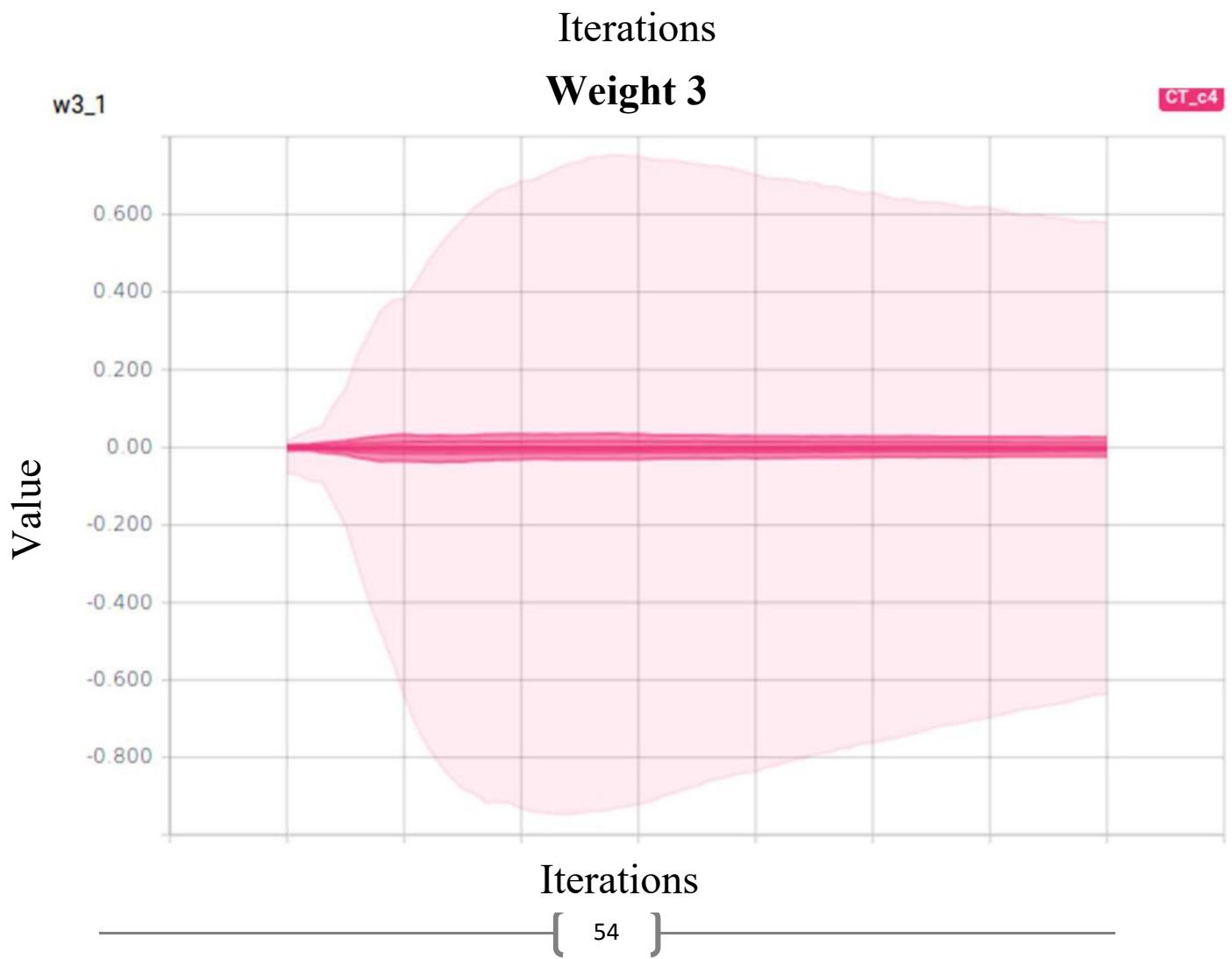




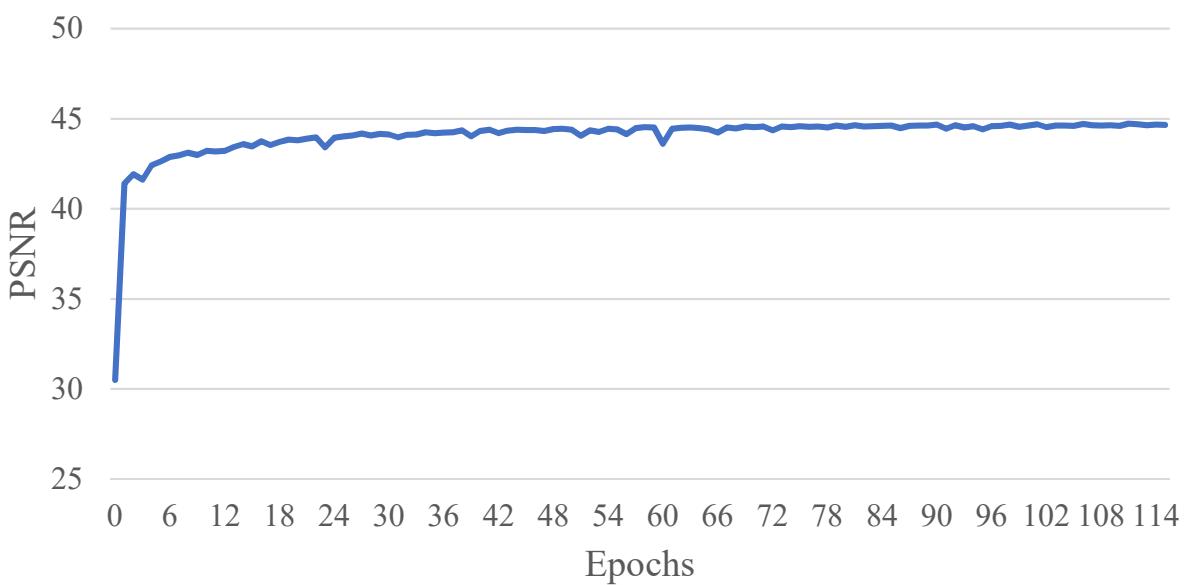
Iterations



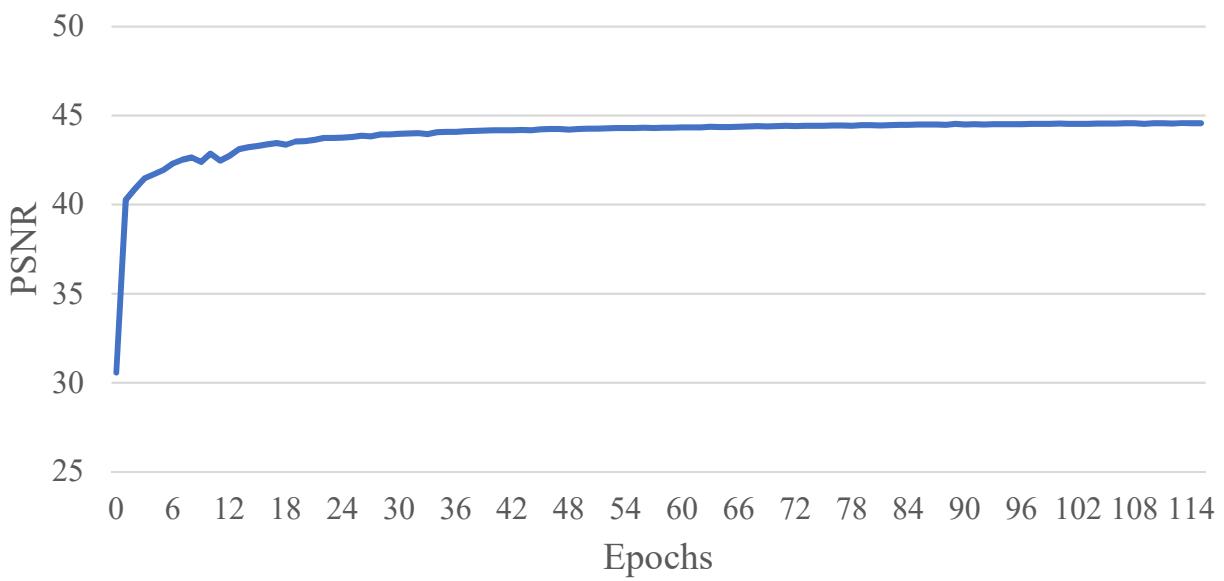
Iterations



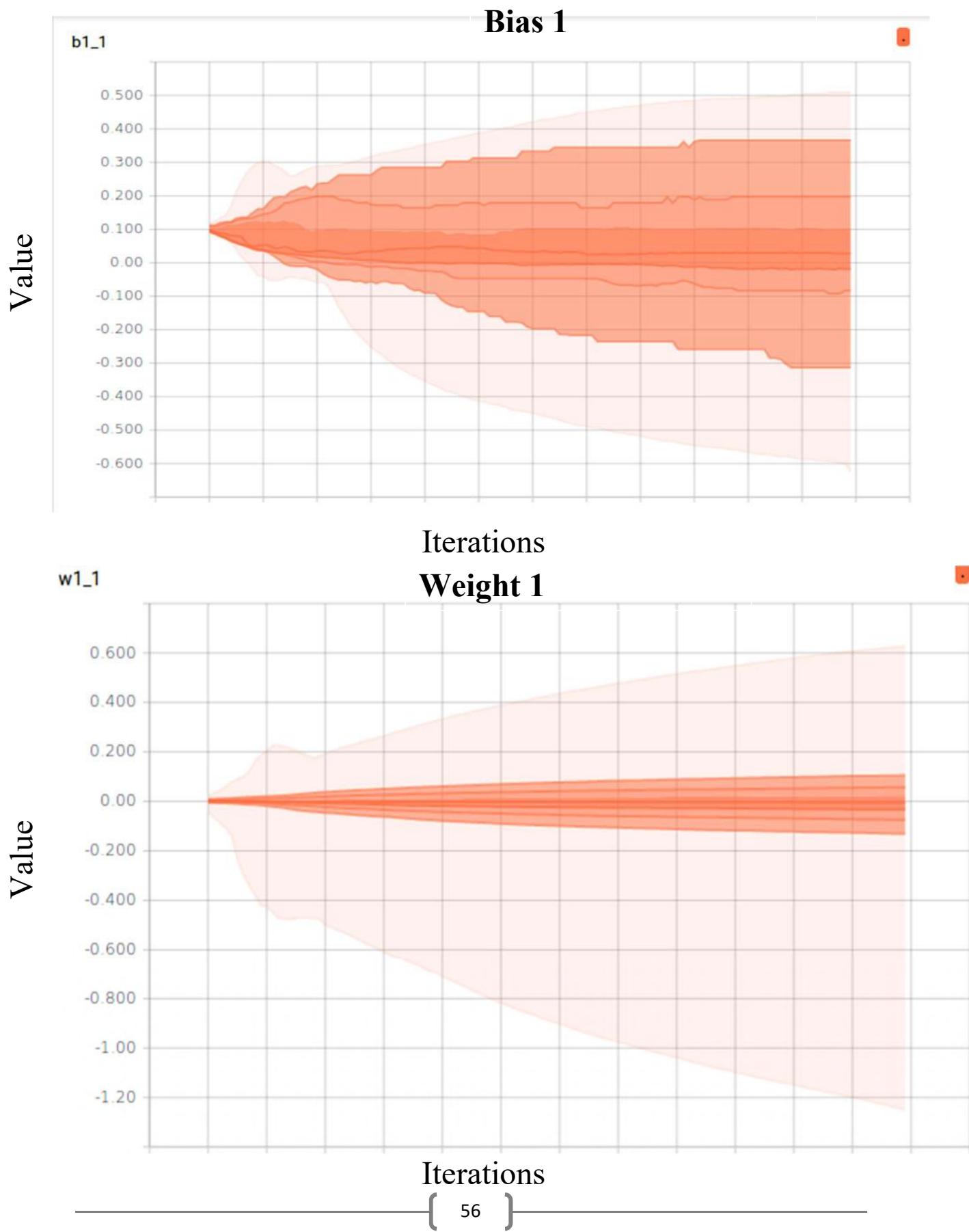
8 Neighbor C-SRCNN Validation Set PSNR on Medical Images

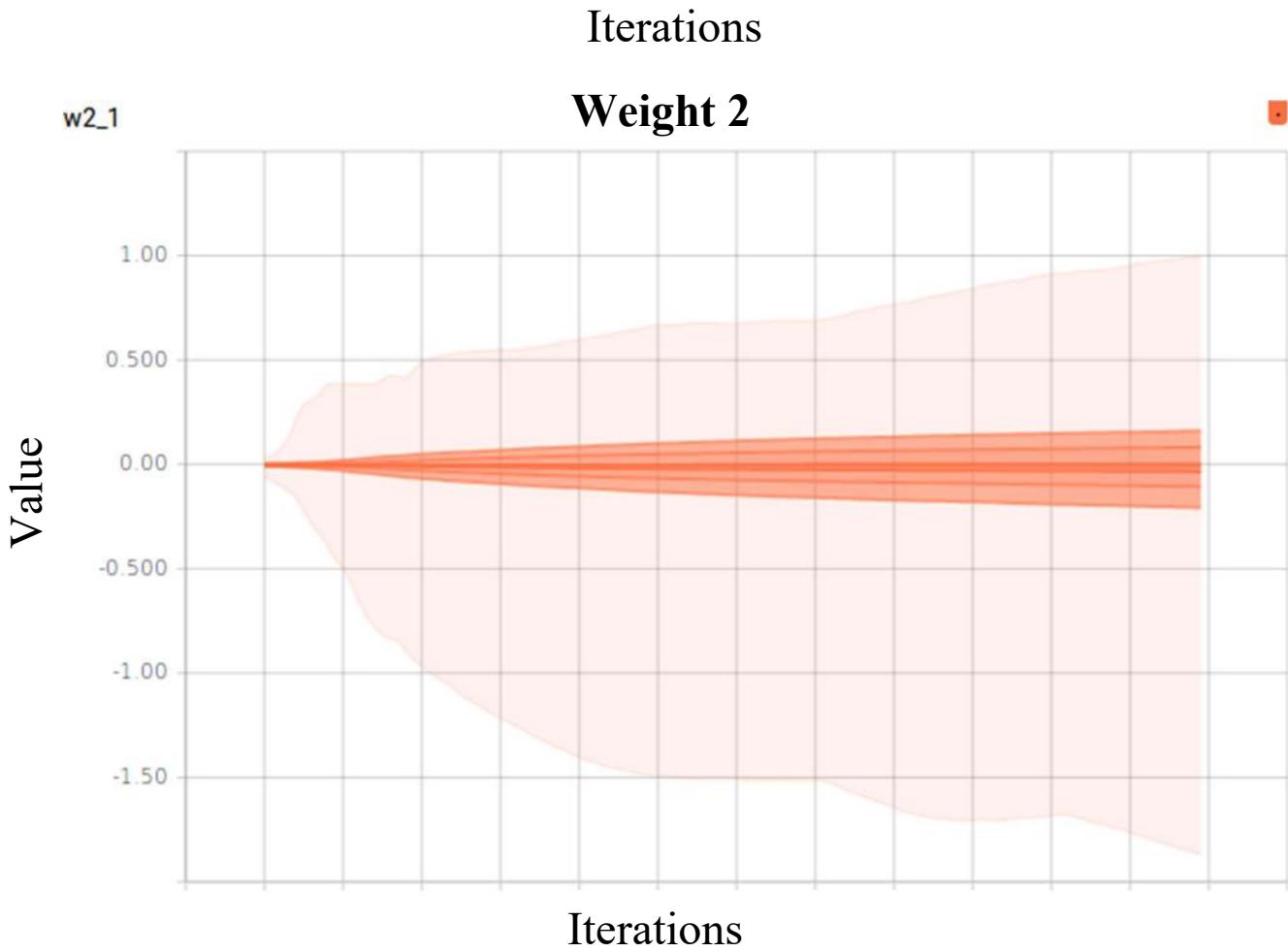
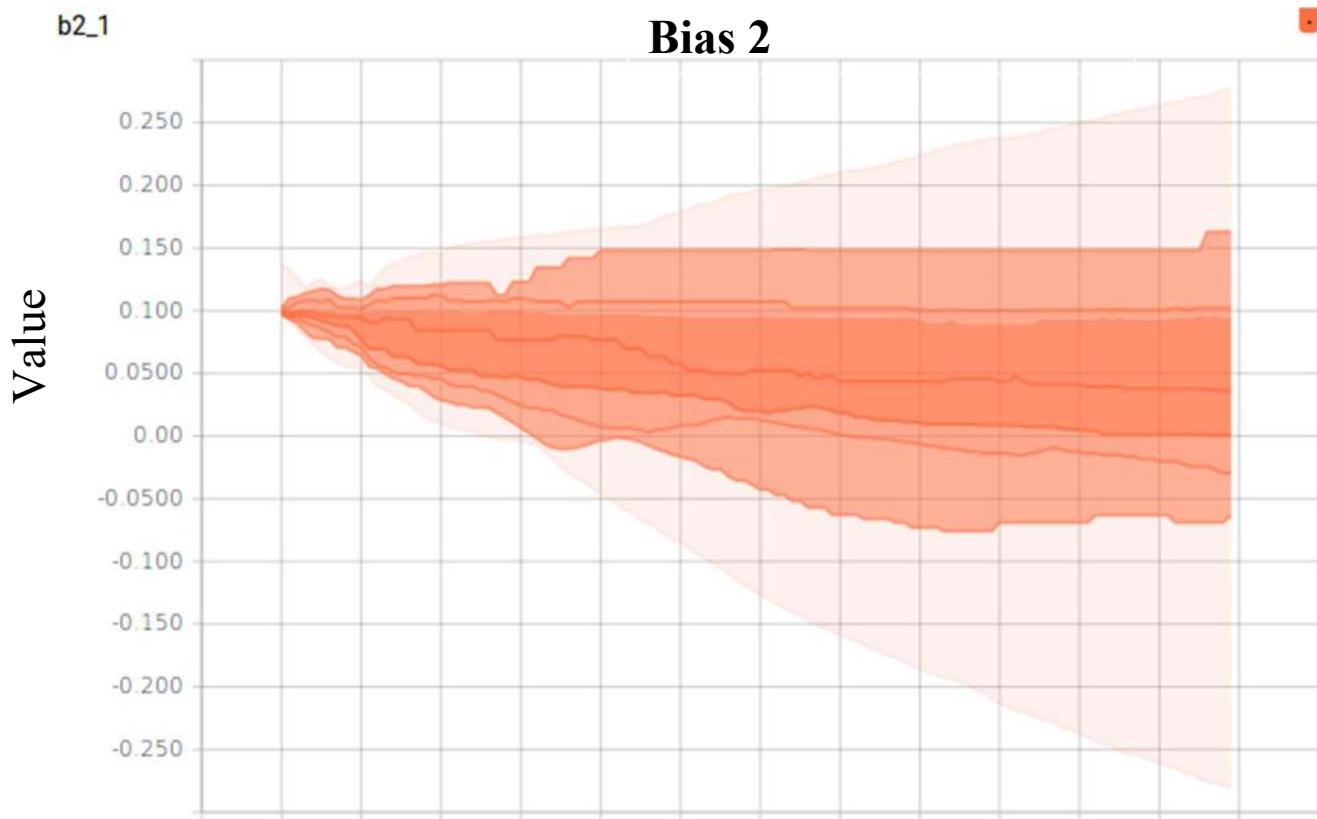


8 Neighbor C-SRCNN Training Set PSNR on Medical Images



Distribution of Biases and Weights for 8 Neighbor C-SRCNN over Epochs (Medical Images)





b3_1

Bias 3

Value

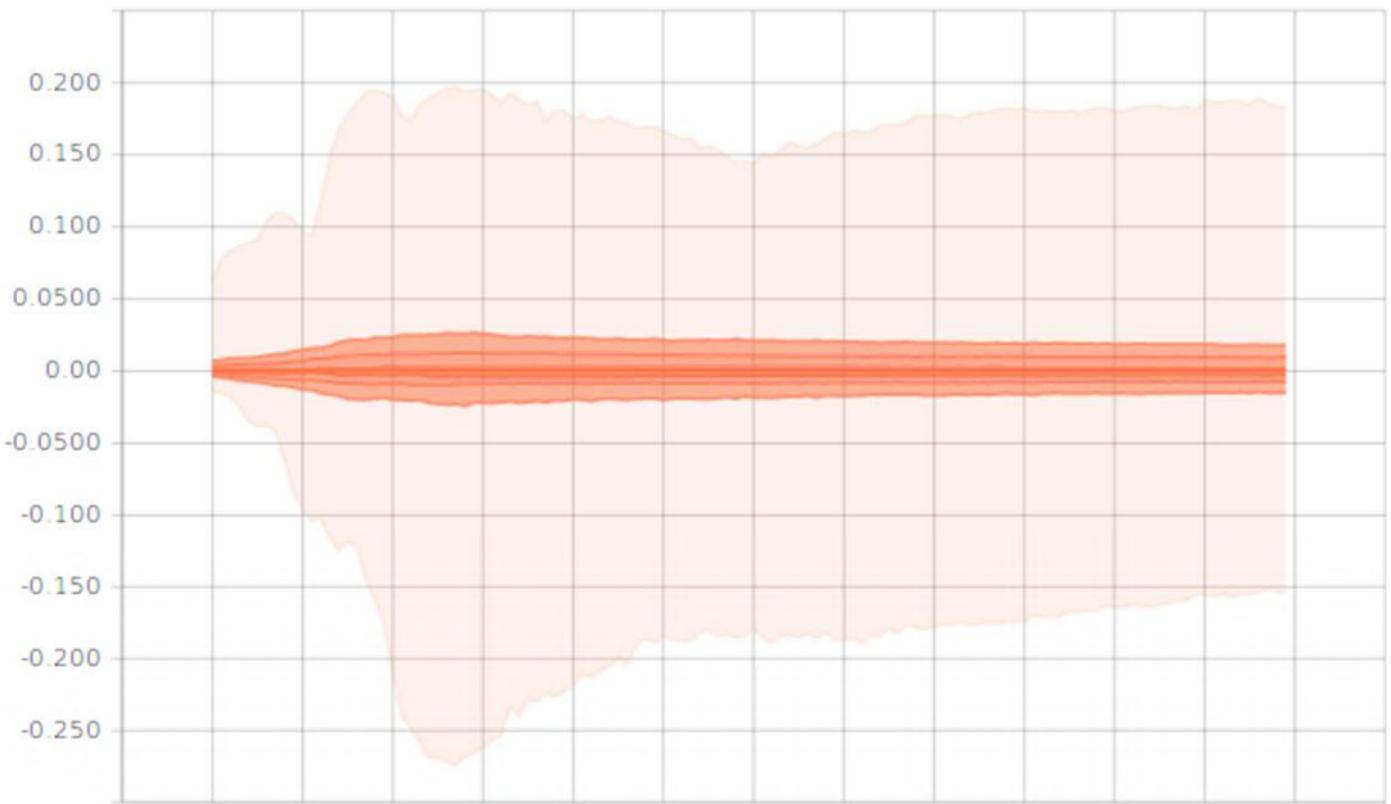


Iterations

Weight 3

w3_1

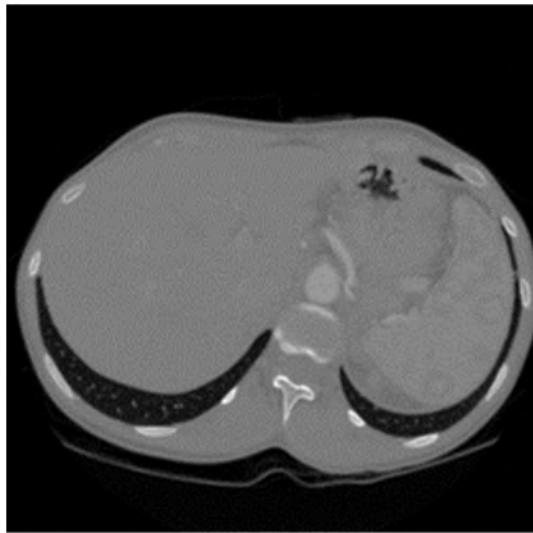
Value



Iterations

Testing (Medical Images) (DICOM Library)

Original

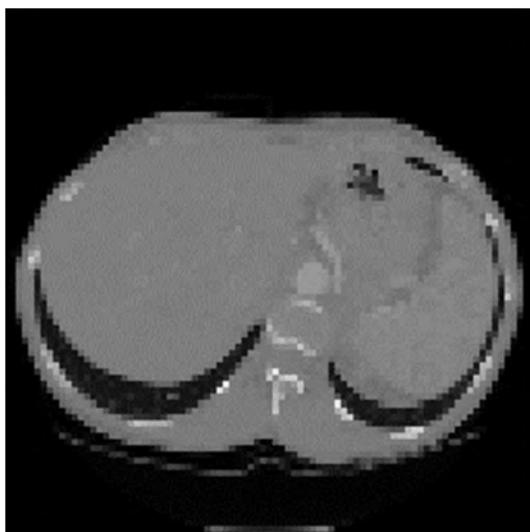


PSNR/SSIM

Results for image16.bmp

Method	PSNR	SSIM
Nearest Neighbor	27.57	.8710
Bicubic	27.98	.8854
SRCCN	27.81	.9297
Extended Patch	27.63	.7459
4 Neighbor	30.96	.9435
8 Neighbor	33.36	.9476

Nearest Neighbor



27.57/0.8710

Bicubic



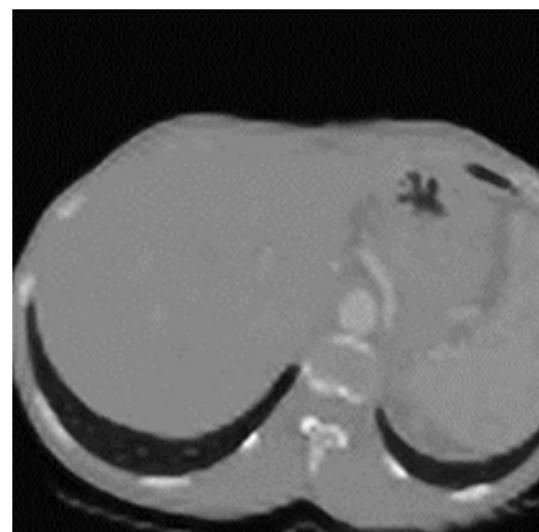
27.98/0.8854

SRCNN



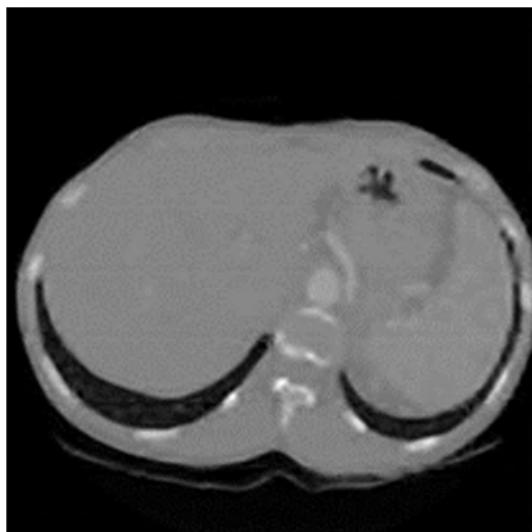
27.81/0.9297

E- SRCNN (Ours)



27.63/0.7459

C5 C-SRCNN (Ours)



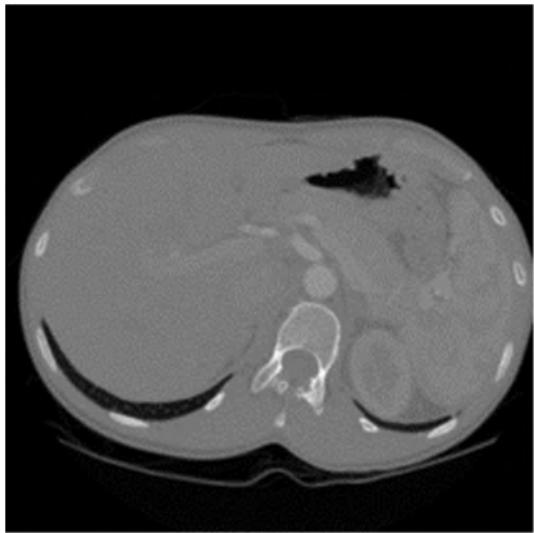
30.96/0.9435

C9 C-SRCNN (Ours)



33.36/0.9476

Original

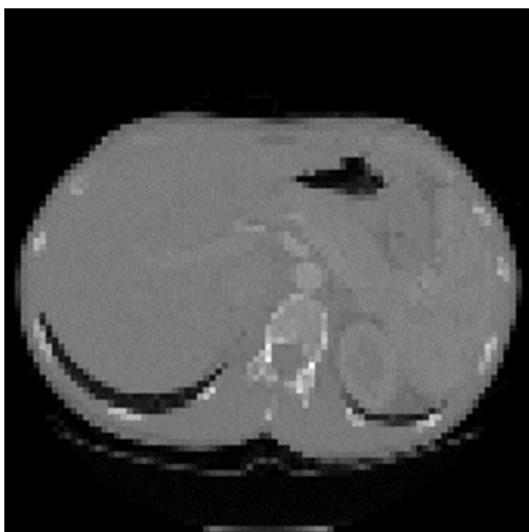


Results for image38.bmp

Method	PSNR	SSIM
Nearest Neighbor	27.41	.8757
Bicubic	28.94	.8892
SRCCN	33.06	.9338
Extended Patch	30.22	.7588
4 Neighbor	34.23	.9452
8 Neighbor	34.75	.9489

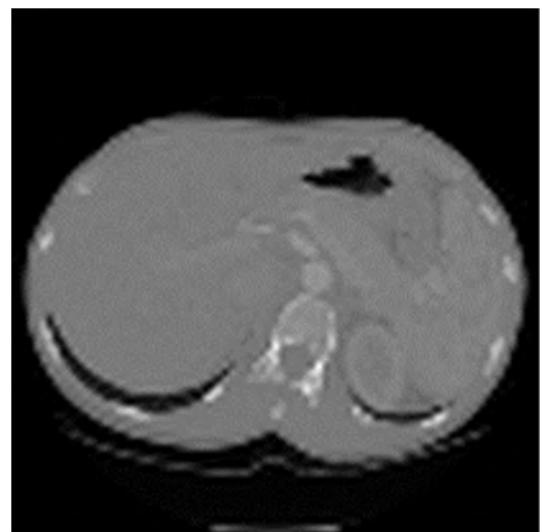
PSNR/SSIM

Nearest Neighbor



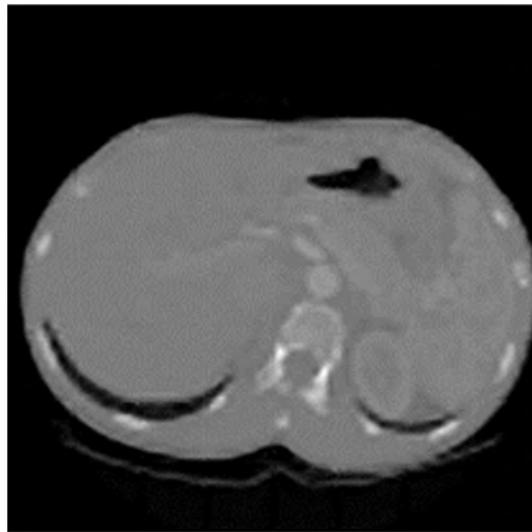
27.41/0.8757

Bicubic



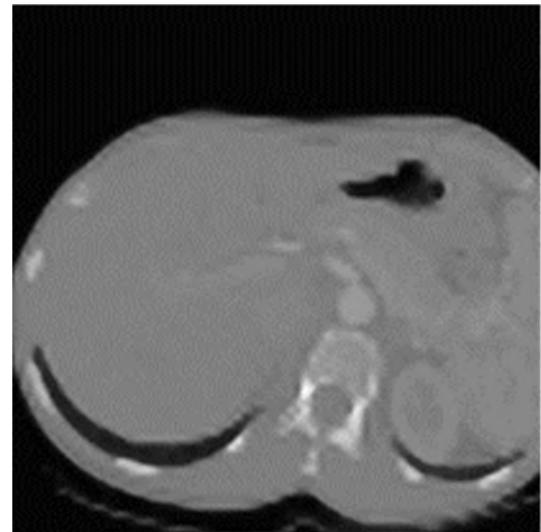
28.94/0.8892

SRCNN



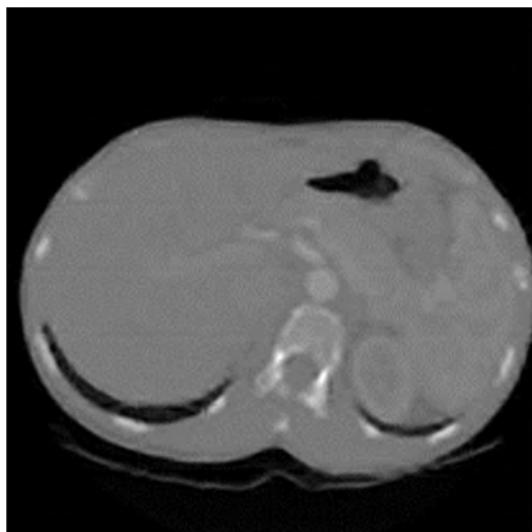
33.06/0.9338

E- SRCNN (Ours)



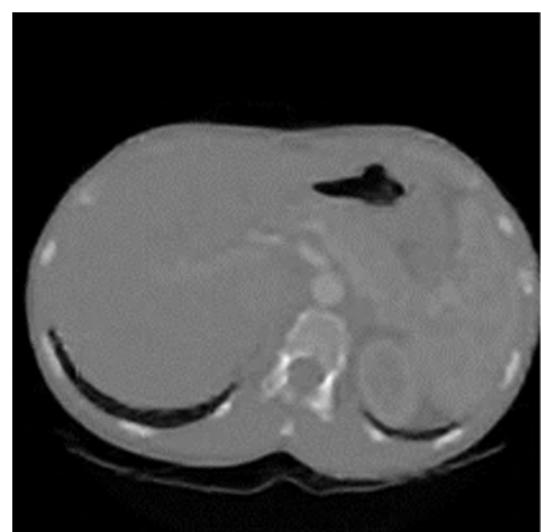
30.22/0.7588

C5 C-SRCNN (Ours)



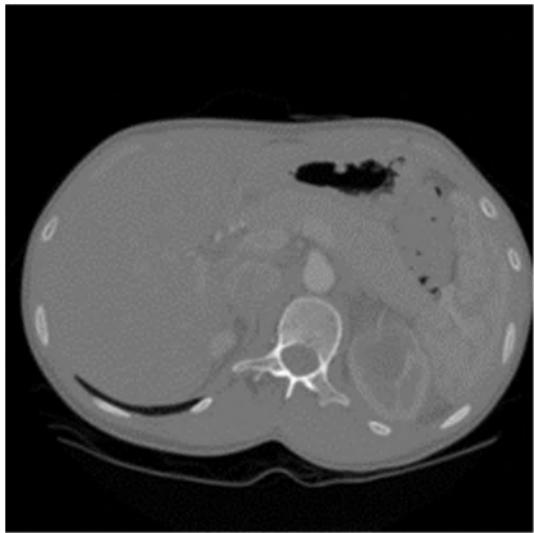
34.23/0.9452

C9 C-SRCNN (Ours)



34.75/0.9489

Original

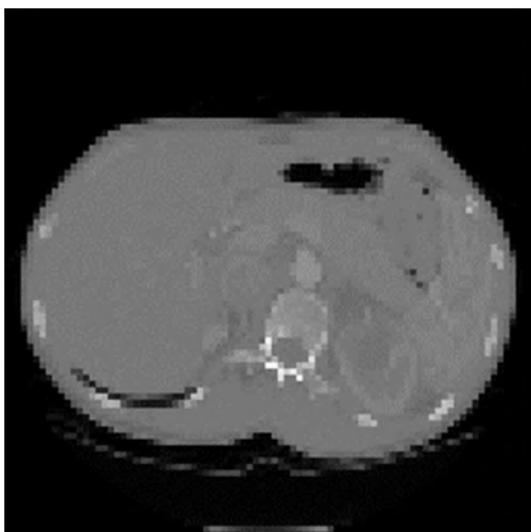


PSNR/SSIM

Results for image56.bmp

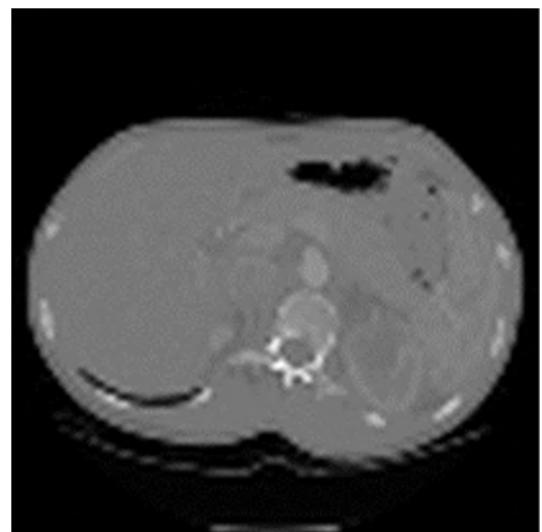
Method	PSNR	SSIM
Nearest Neighbor	26.97	.8736
Bicubic	29.54	.8902
SRCCN	32.89	.9327
Extended Patch	32.24	.7590
4 Neighbor	34.44	.9443
8 Neighbor	34.85	.9482

Nearest Neighbor



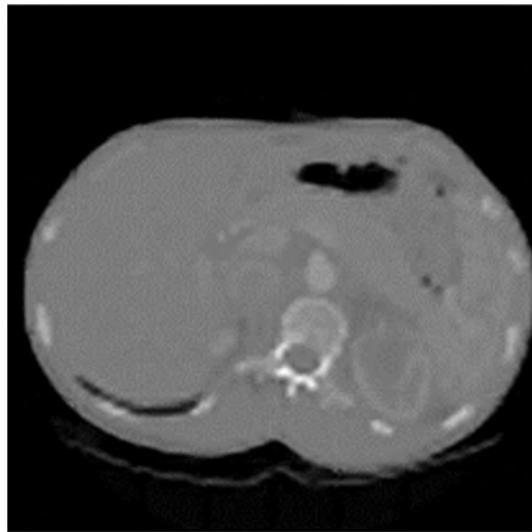
26.97/0.8736

Bicubic



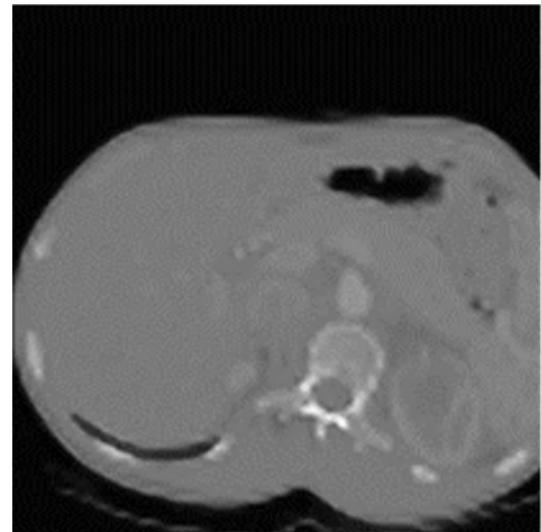
29.54/0.8902

SRCNN



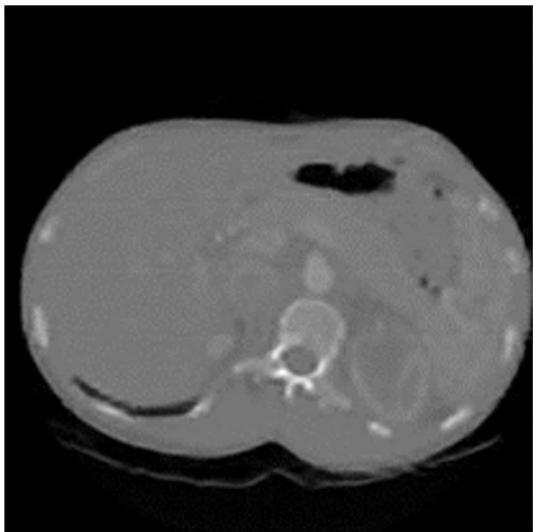
32.89/0.9327

E- SRCNN (Ours)



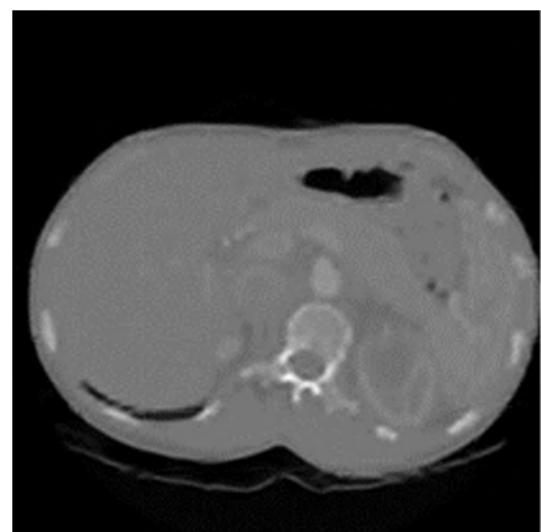
32.24/0.7590

C5 C-SRCNN (Ours)
e



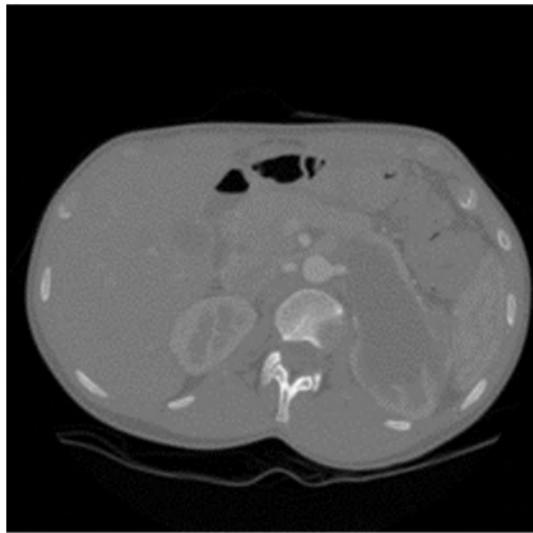
34.44/0.9443

C9 C-SRCNN (Ours)



34.85/0.9482

Original

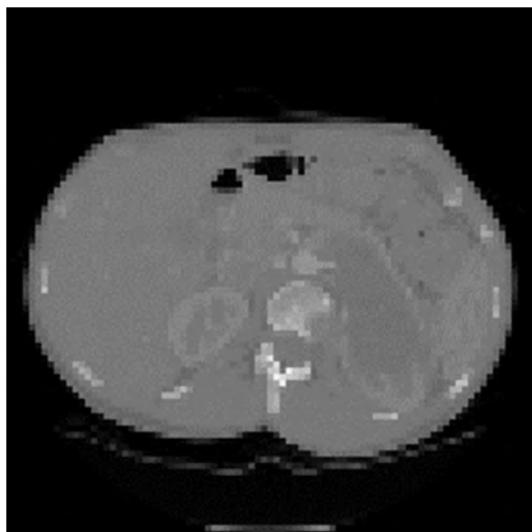


PSNR/SSIM

Results for image86.bmp

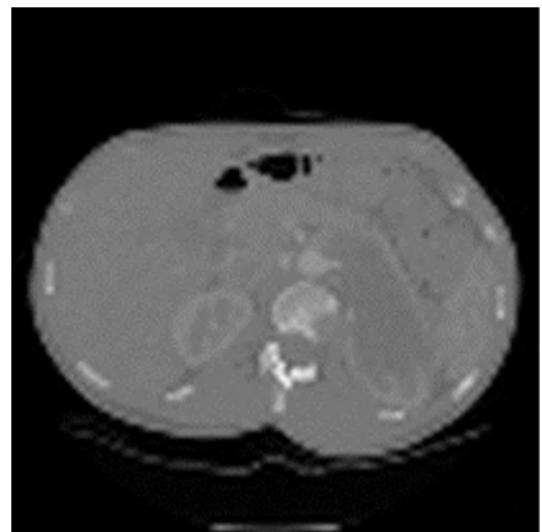
Method	PSNR	SSIM
Nearest Neighbor	27.52	.8779
Bicubic	30.05	.8931
SRCCN	29.24	.9323
Extended Patch	32.50	.7653
4 Neighbor	32.62	.9448
8 Neighbor	32.72	.9462

Nearest Neighbor



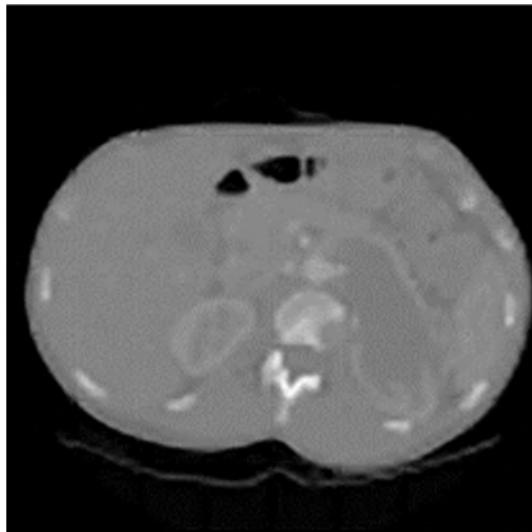
27.52/0.8779

Bicubic



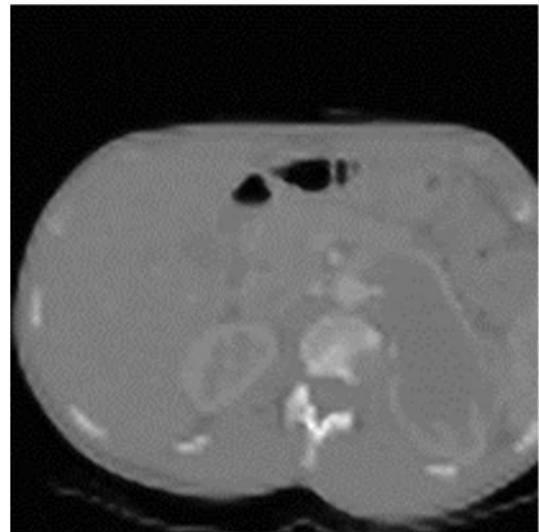
30.05/0.8931

SRCNN



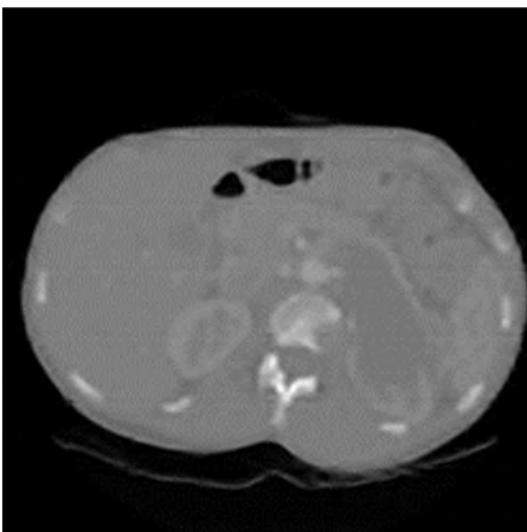
29.24 .9323

E- SRCNN (Ours)



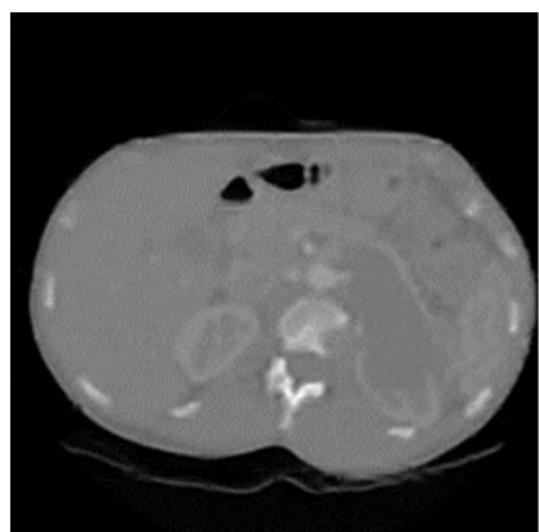
32.50/0.7653

C5 C-SRCNN (Ours)



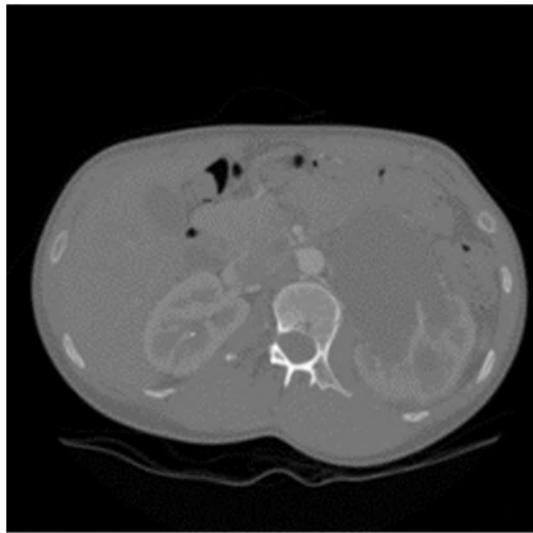
32.62/0.9448

C9 C-SRCNN (Ours)



32.72/0.9462

Original

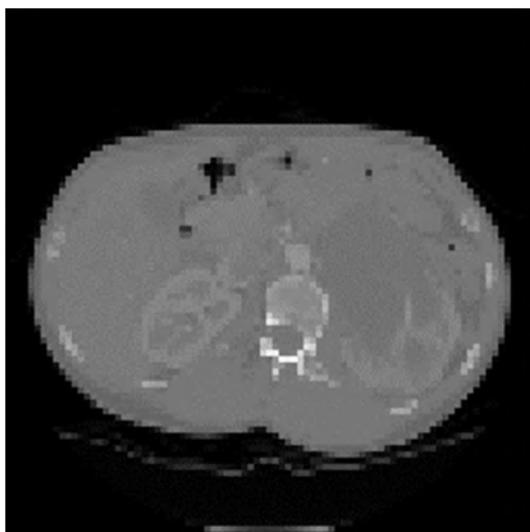


PSNR/SSIM

Results for image100.bmp

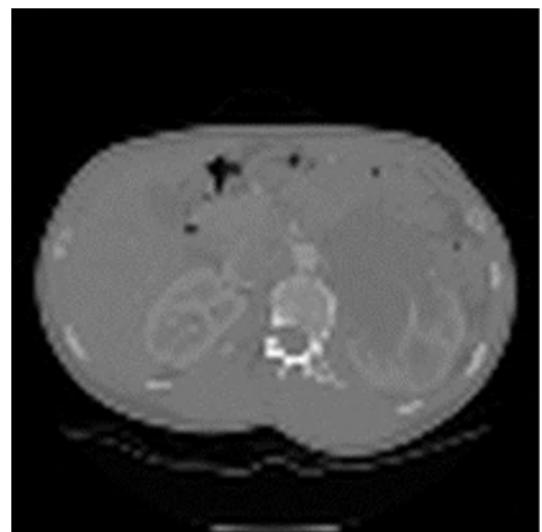
Method	PSNR	SSIM
Nearest Neighbor	27.57	.8765
Bicubic	30.22	.8897
SRCCN	29.70	.9294
Extended Patch	27.59	.7253
4 Neighbor	33.66	.9422
8 Neighbor	34.06	.9458

Nearest Neighbor



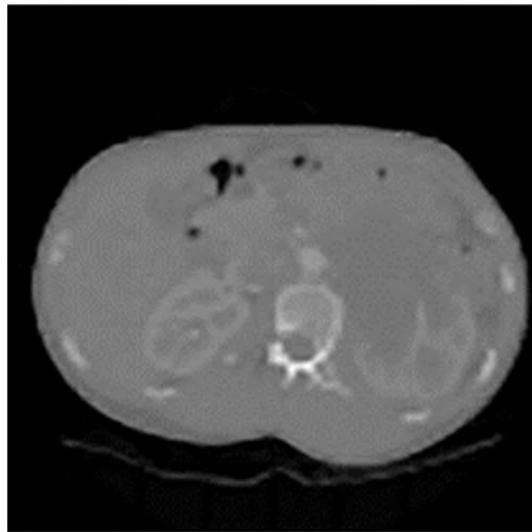
27.57/0.8765

Bicubic



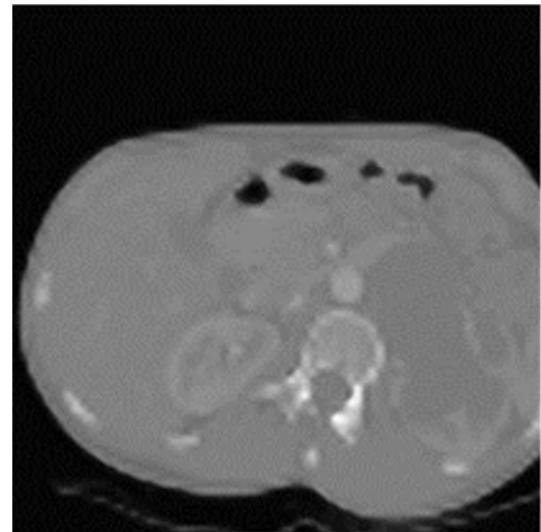
30.22/0.8897

SRCNN



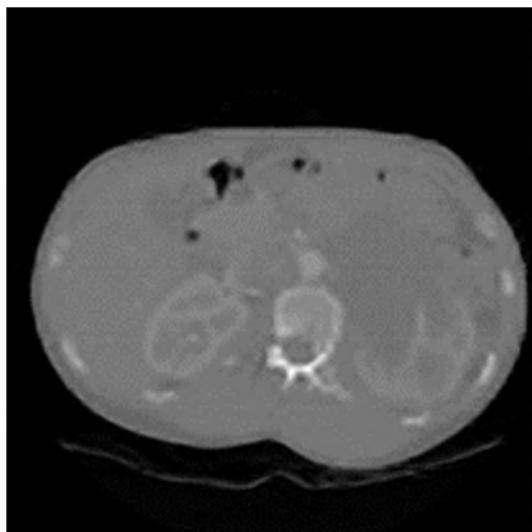
29.70/0.9294

E- SRCNN (Ours)



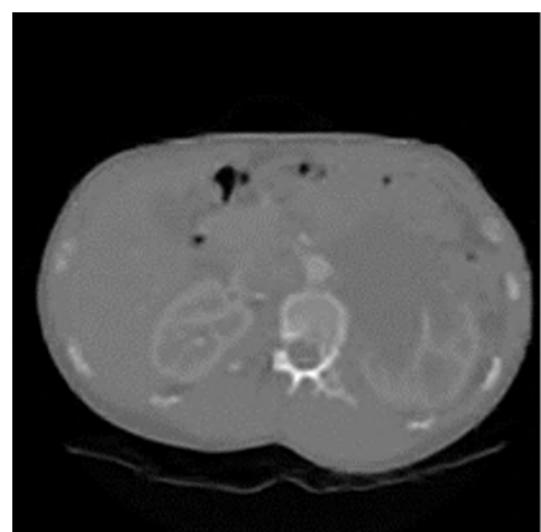
27.59/0.7253

C5 C-SRCNN (Ours)



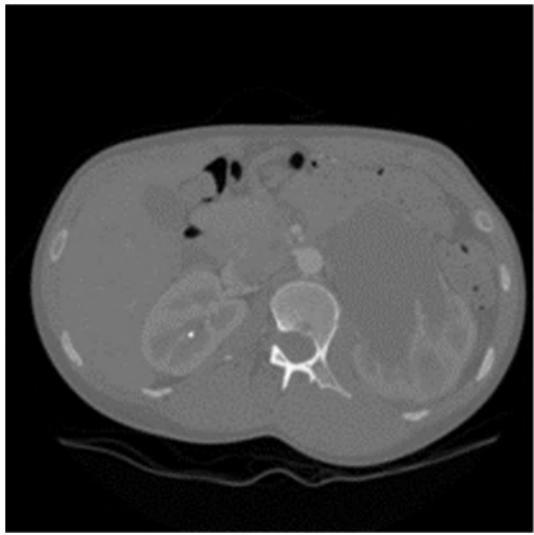
33.66/0.9422

C9 C-SRCNN (Ours)



34.06/0.9458

Original

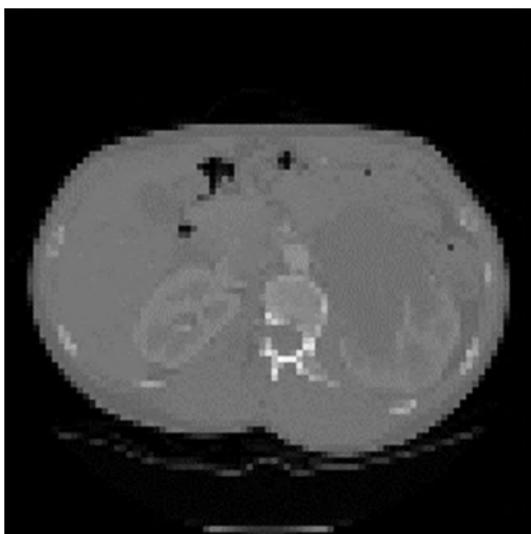


PSNR/SSIM

Results for image118.bmp

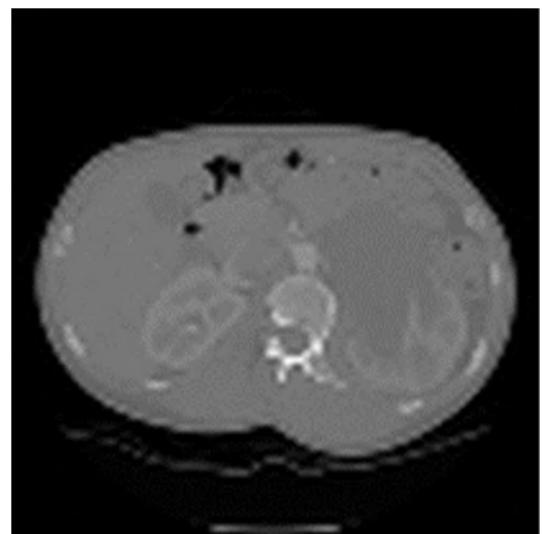
Method	PSNR	SSIM
Nearest Neighbor	27.41	.8757
Bicubic	30.23	.8907
SRCCN	34.59	.9329
Extended Patch	30.93	.7212
4 Neighbor	35.24	.9442
8 Neighbor	35.67	.9488

Nearest Neighbor



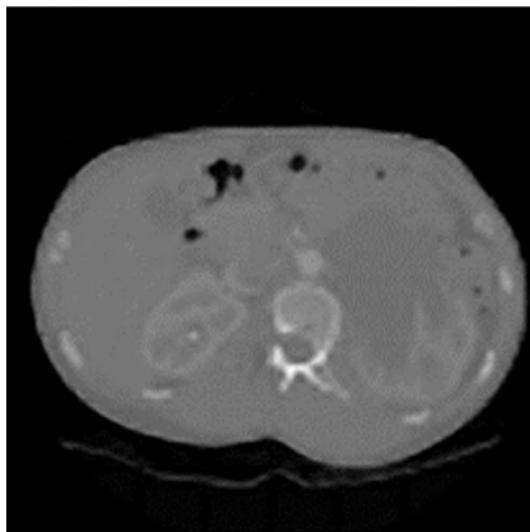
27.41/0.8757

Bicubic



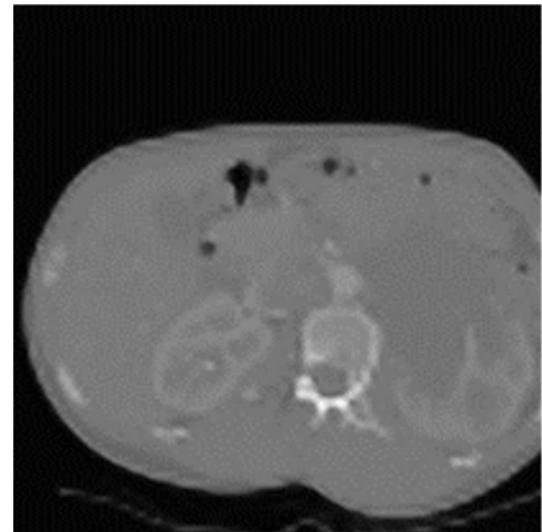
30.23/0.8907

SRCNN



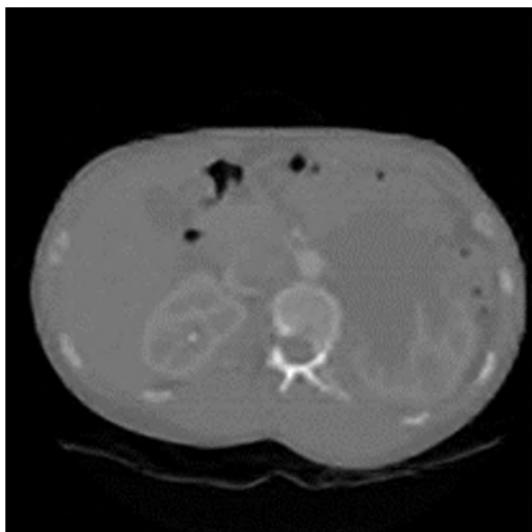
34.59/0.9329

E- SRCNN (Ours)



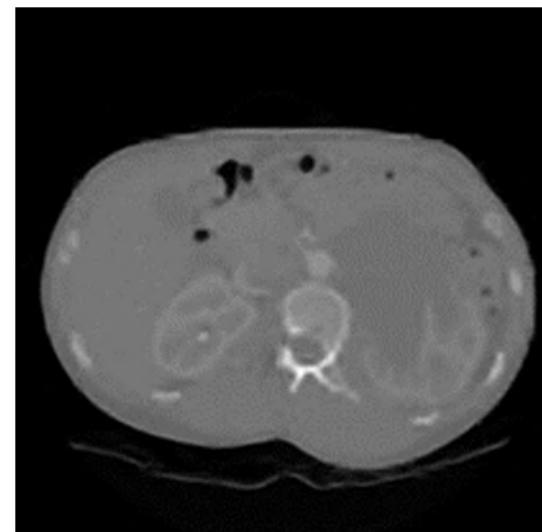
30.93 .7212

C5 C-SRCNN (Ours)



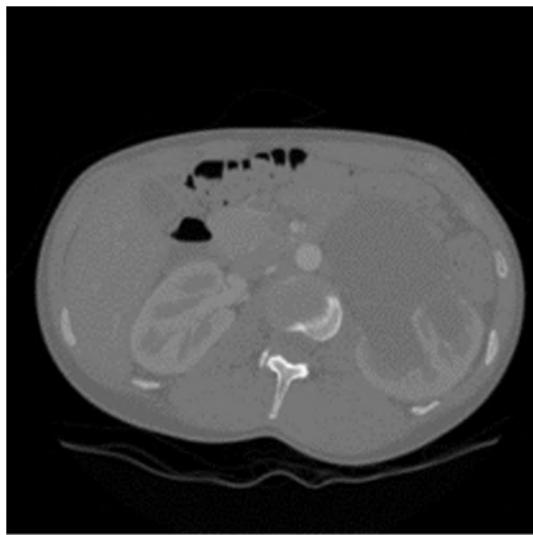
35.24/0.9442

C9 C-SRCNN (Ours)



35.67/0.9488

Original

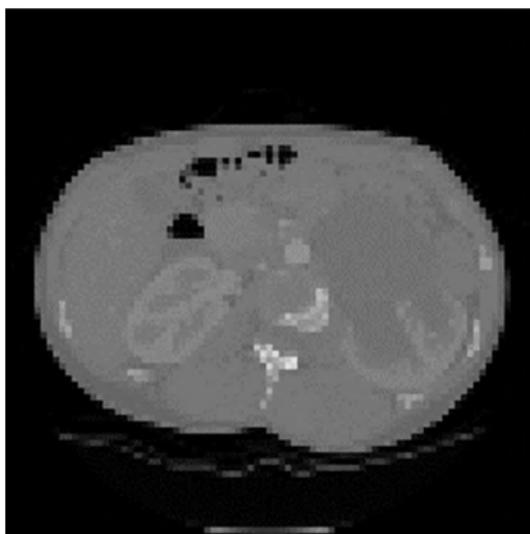


PSNR/SSIM

Results for image 136.bmp

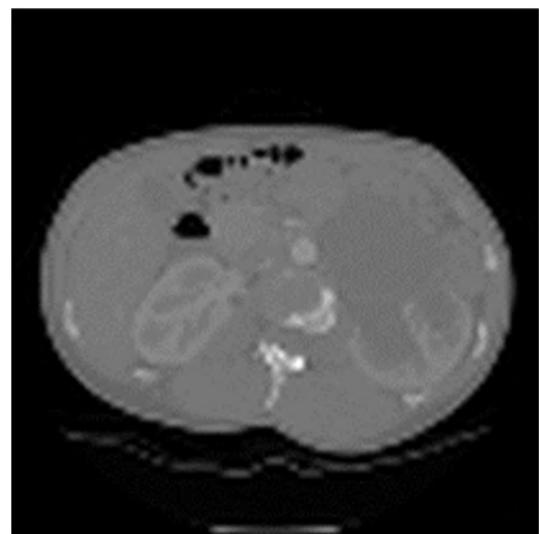
Method	PSNR	SSIM
Nearest Neighbor	27.42	.8801
Bicubic	30.07	.8914
SRCCN	34.57	.9322
Extended Patch	32.49	.7265
4 Neighbor	35.34	.9464
8 Neighbor	35.73	.9508

Nearest Neighbor



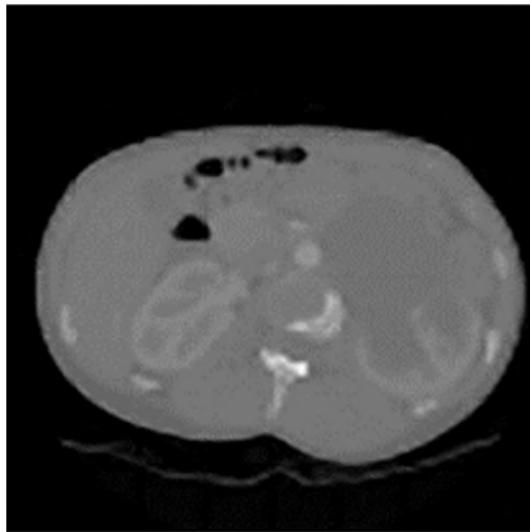
27.42/0.8801

Bicubic



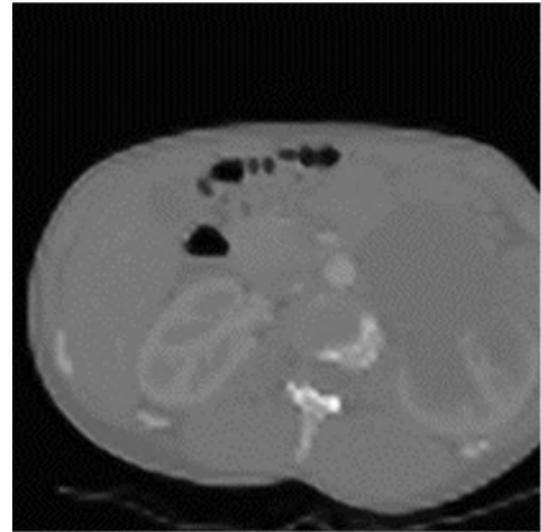
30.07/0.8914

SRCNN



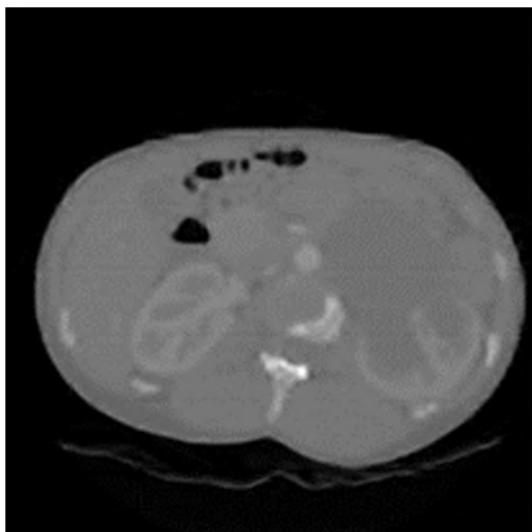
34.57/0.9322

E- SRCNN (Ours)



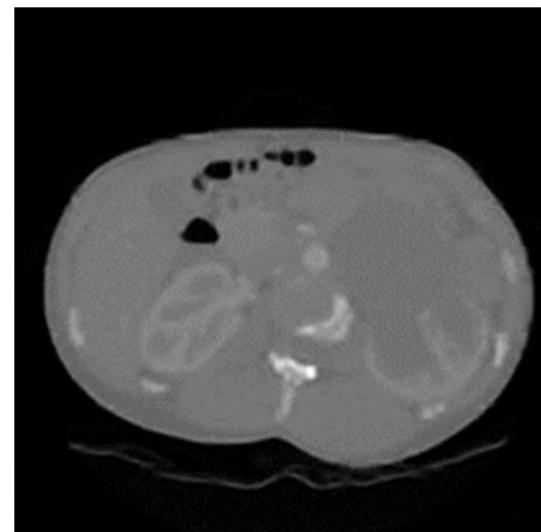
32.49/0.7265

C5 C-SRCNN (Ours)



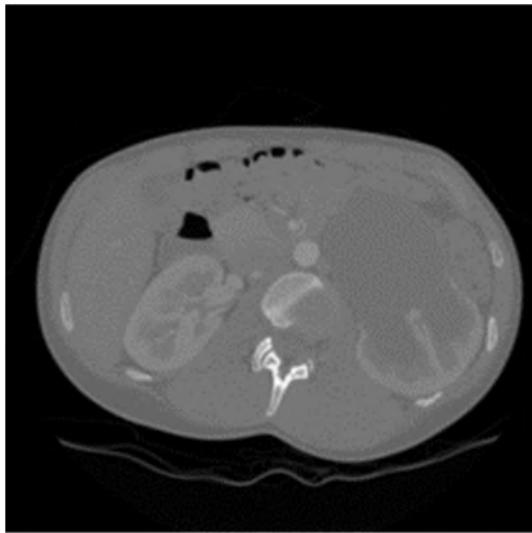
35.34/0.9464

C9 C-SRCNN (Ours)



35.73/0.9508

Original

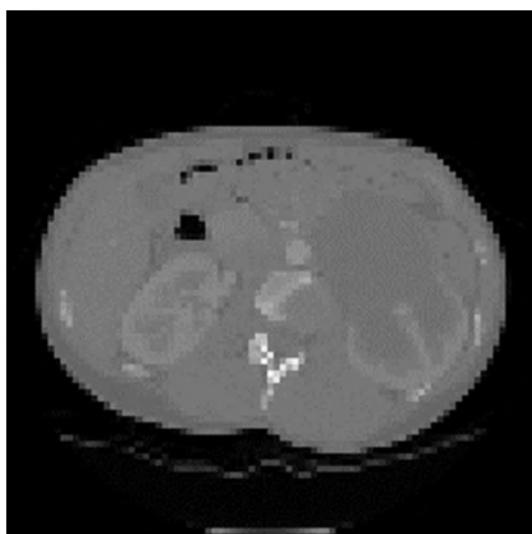


PSNR/SSIM

Results for image 146.bmp

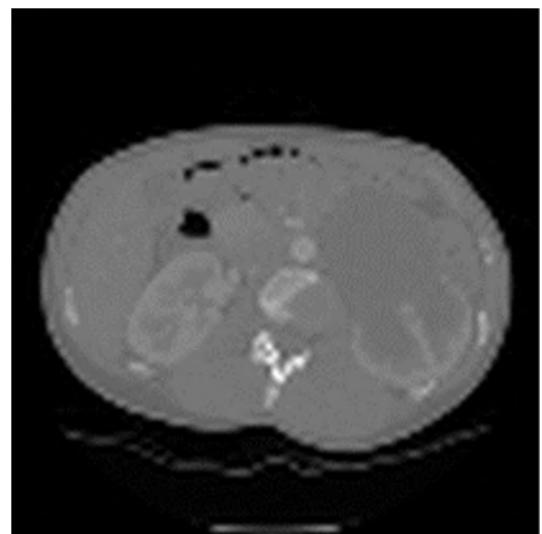
Method	PSNR	SSIM
Nearest Neighbor	27.43	.8820
Bicubic	30.13	.8917
SRCCN	34.43	.9339
Extended Patch	31.86	.7243
4 Neighbor	35.50	.9483
8 Neighbor	35.20	.9517

Nearest Neighbor



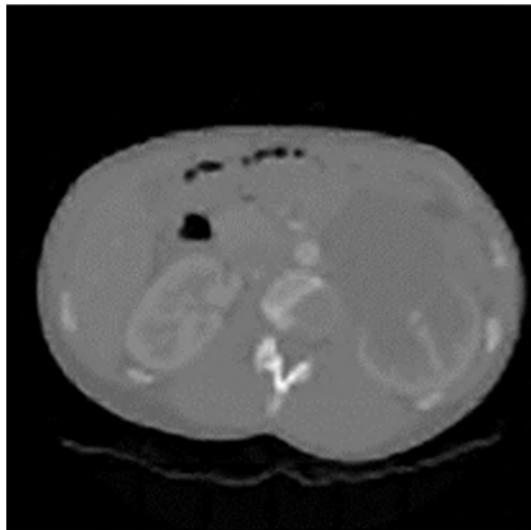
27.43/0.8820

Bicubic



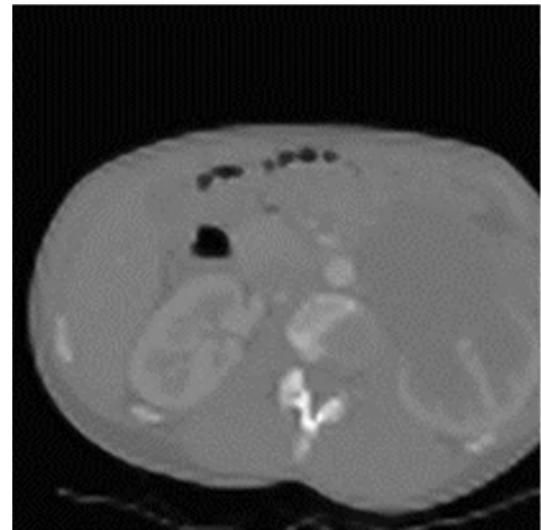
30.13/0.8917

SRCNN



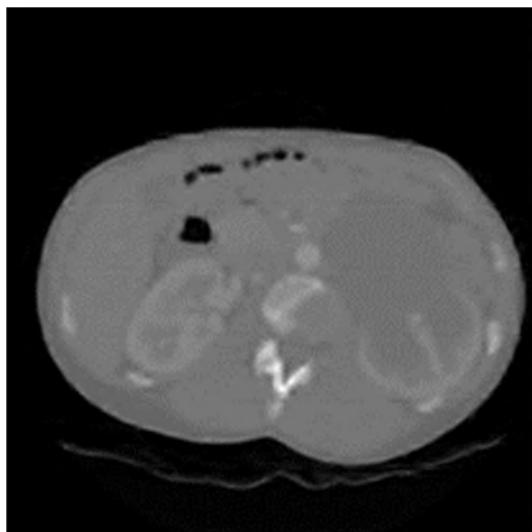
34.43/0.9339

E- SRCNN (Ours)



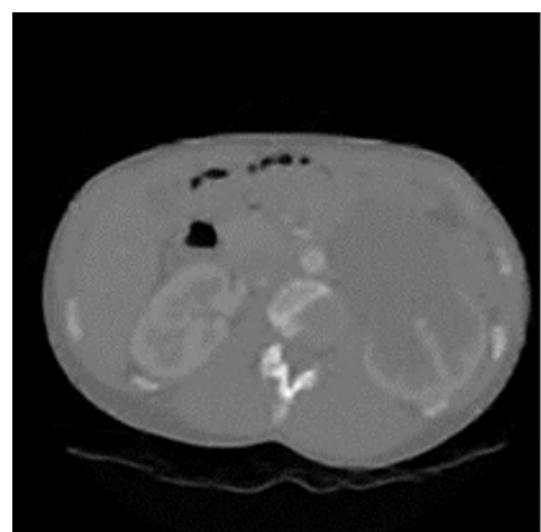
31.86/0.7243

C5 C-SRCNN (Ours)



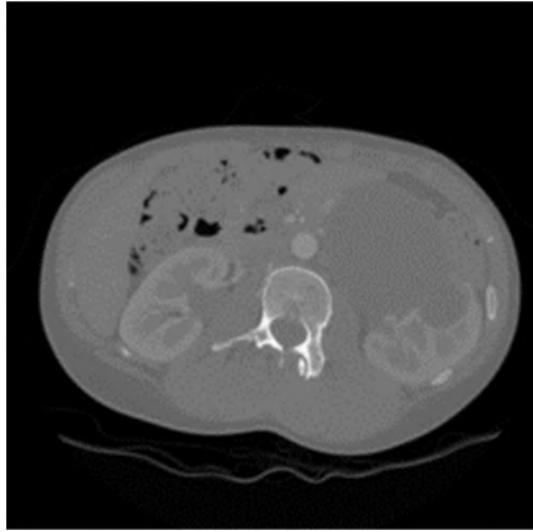
35.50/0.9483

C9 C-SRCNN (Ours)



35.20/0.9517

Original

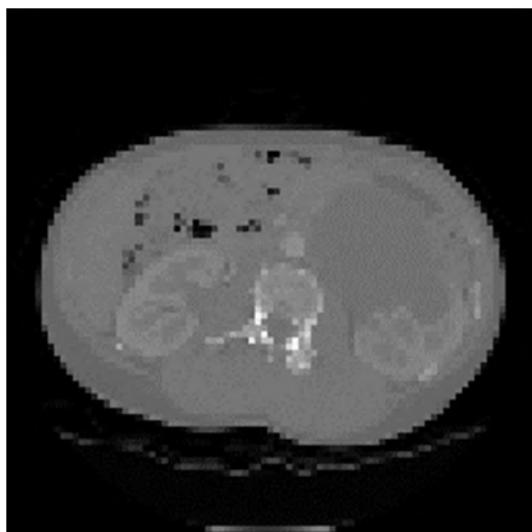


PSNR/SSIM

Results for image170.bmp

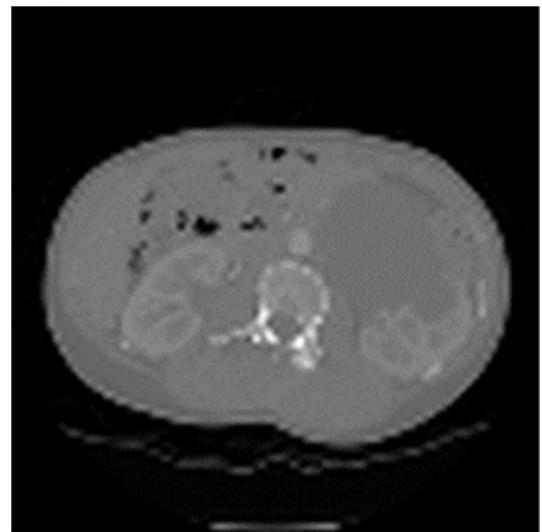
Method	PSNR	SSIM
Nearest Neighbor	27.68	.8757
Bicubic	29.97	.8821
SRCCN	34.02	.9309
Extended Patch	31.81	.7063
4 Neighbor	35.01	.9431
8 Neighbor	35.11	.9463

Nearest Neighbor



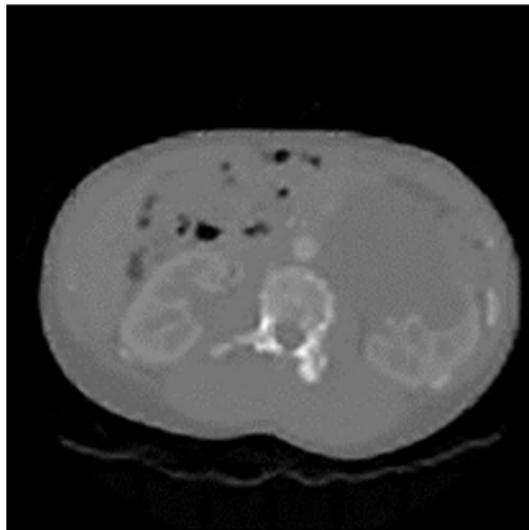
27.68/0.8757

Bicubic



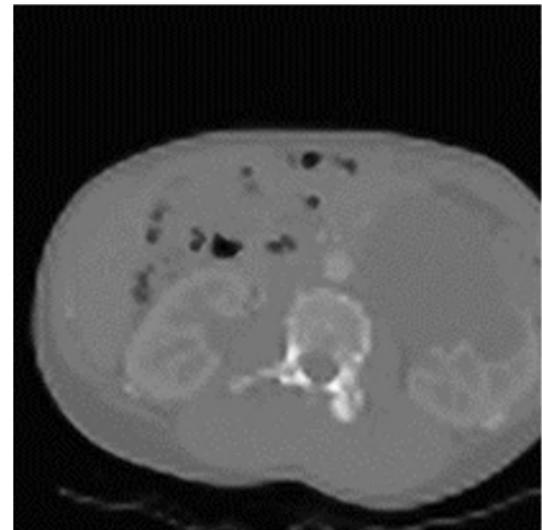
29.97/0.8821

SRCNN



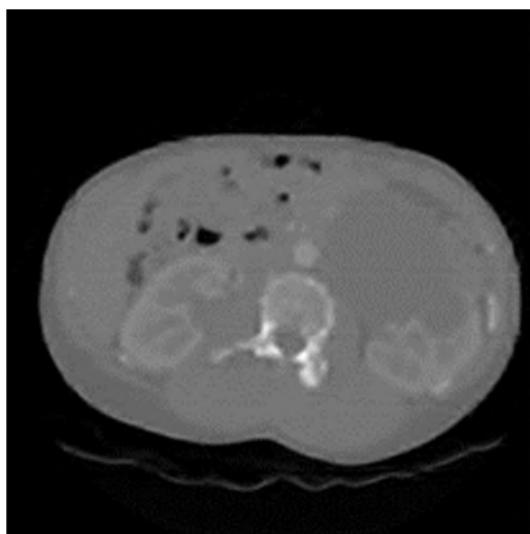
34.02/0.9309

E- SRCNN (Ours)



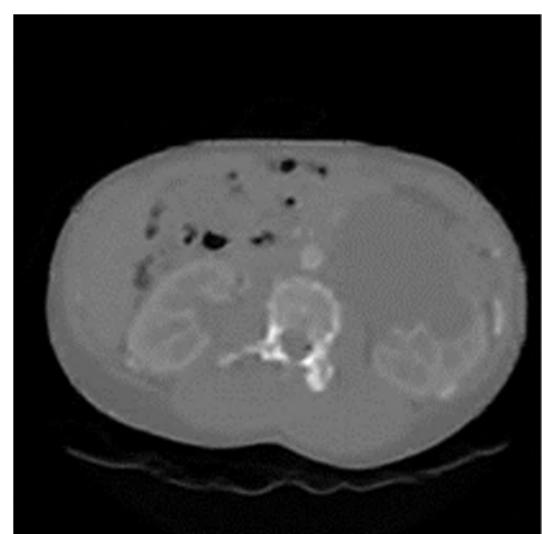
31.81/0.7063

C5 C-SRCNN (Ours)



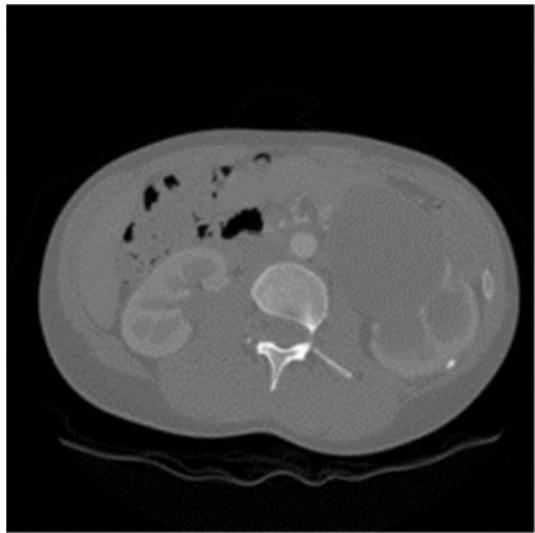
35.01/0.9431

C9 C-SRCNN (Ours)



35.11/0.9463

Original

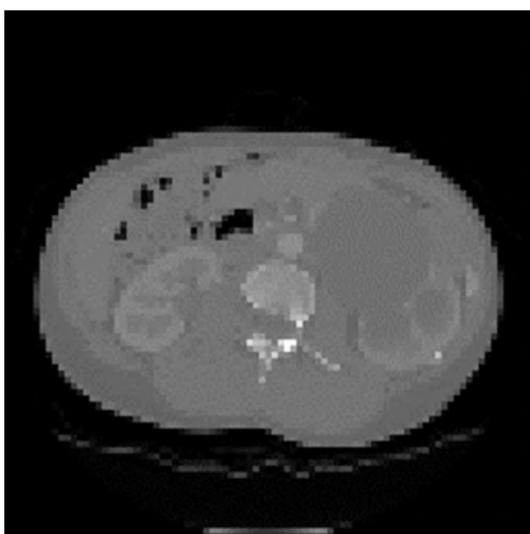


PSNR/SSIM

Results for image188.bmp

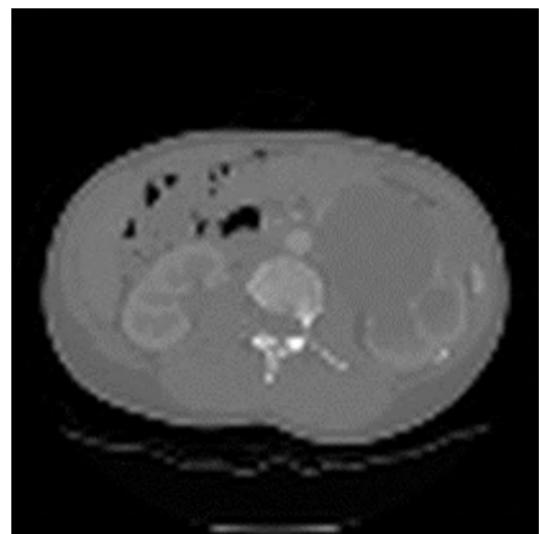
Method	PSNR	SSIM
Nearest Neighbor	27.92	.8839
Bicubic	30.24	.8884
SRCCN	35.08	.9376
Extended Patch	32.03	.6974
4 Neighbor	35.85	.9484
8 Neighbor	35.88	.9507

Nearest Neighbor



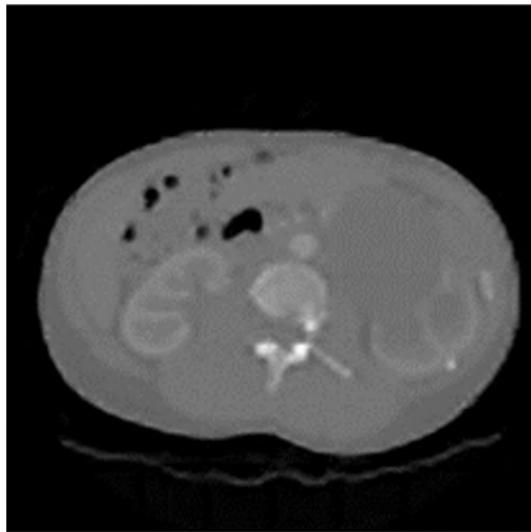
27.92/0.8839

Bicubic



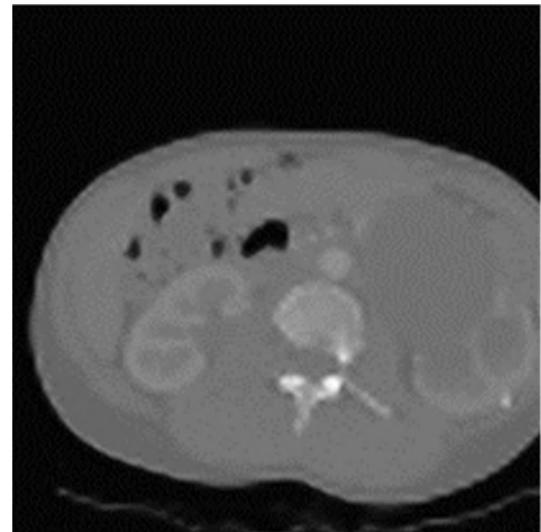
30.24/0.8884

SRCNN



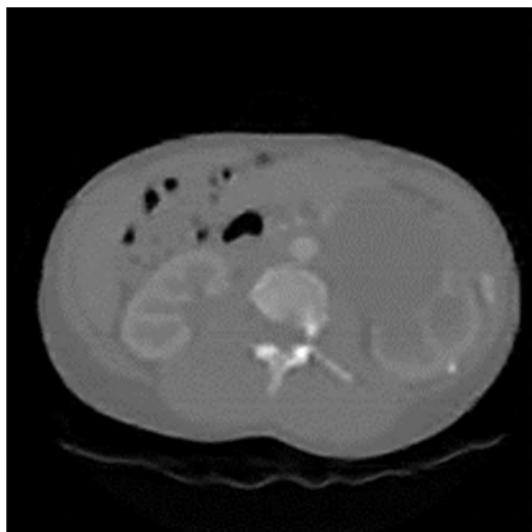
35.08/0.9376

E- SRCNN (Ours)



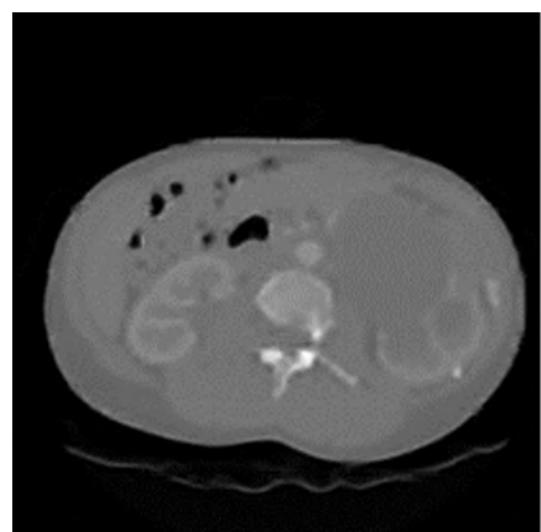
32.03/0.6974

C5 C-SRCNN (Ours)



35.85/0.9484

C9 C-SRCNN (Ours)



35.88/0.9507

Radiologist Evaluations

In a survey aiming to evaluate the real-world applications of our model, we randomized the order of images generated by various super-resolution methods and asked for radiologists to rank the images based on usefulness. Aggregated results had C-SRCNN place first and SRCNN far behind. In general, subjective comments stated that images generated by C-SRCNN have greater contrast, sharper margins, and less noise, all of which greatly increase the quality of patient care. The following pages consist of evaluations of the images that various super-resolution methods produced by medical professionals. The table below summarizes our subjective scores, with 1 being the best image and 3 being the worst.

Radiologist	Image Set	Ranking		
		Bicubic	SRCCN	C-SRCCN
1	Average	1.75	2.50	1.75
	1	1	3	2
	2	3	1	2
	3	2	3	1
	4	1	3	2
2	Average	1.50	2.50	2.00
	1	1	3	2
	2	3	2	1
	3	1	2	3
	4	1	3	2
3	Average	2.00	2.50	1.50
	1	1	3	2
	2	3	2	1
	3	3	2	1
	4	1	3	2
4	Average	3.00	1.50	1.50
	1	3	1	2
	2	3	2	1
	3	3	2	1
	4	3	1	2
Overall		2.0625	2.2500	1.6875

Mean Opinion Score Survey

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Please sign your name below as confirmation the survey was answered honestly and without bias. We appreciate your support.

1	High Quality
2	Medium Quality
3	Lowest Quality

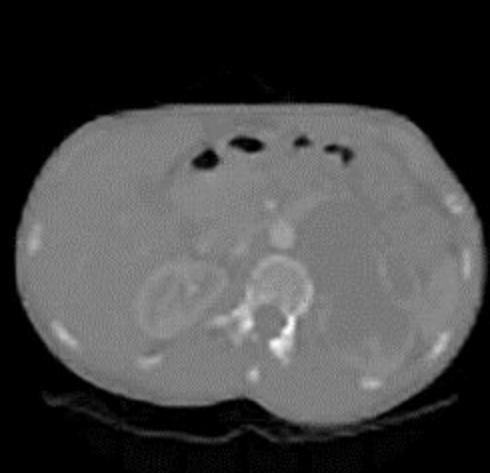
Sami Khan, M.D.

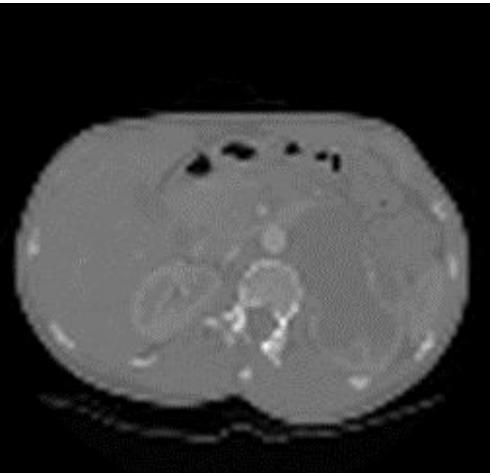
Printed Name
Regional Medical Imaging

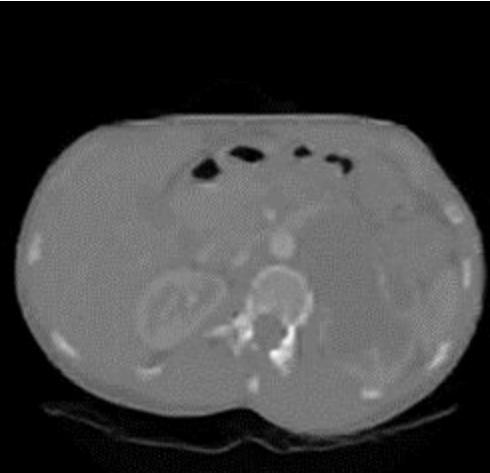
Institution
Sami Khan

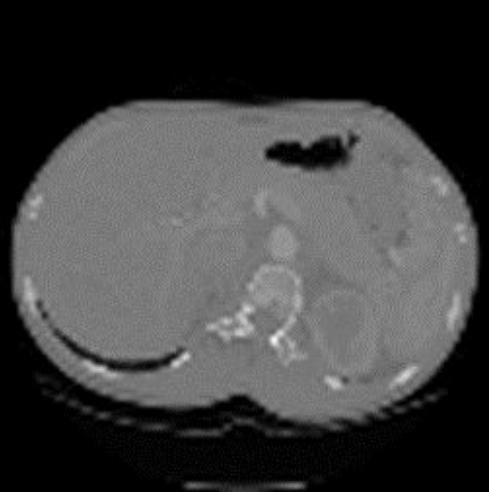
Signature

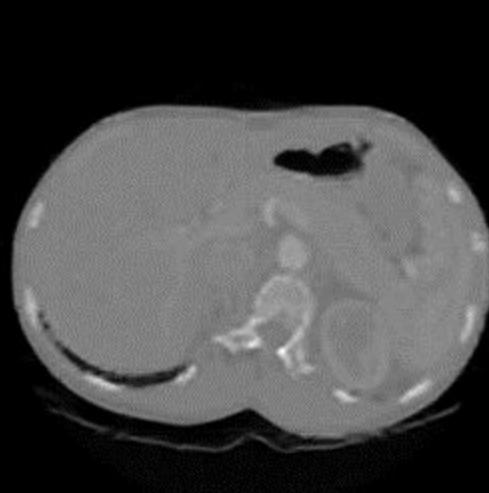
[1] Dong, Chao, et al. "Image super-resolution using deep convolutional networks." *IEEE transactions on pattern analysis and machine intelligence* 38.2 (2016): 295-307.

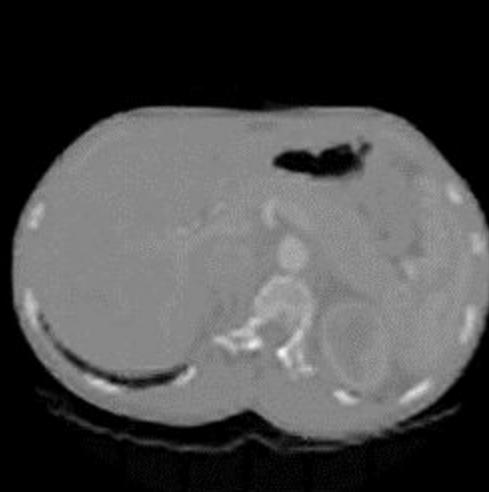
	Score: 3	Subjective Comments: Very grainy image. Ribs are blurry and lot of dark pixels (noise) in abdomen
---	-------------	--

	Score: 1	Subjective Comments: Best appearing of the 3. Looks like a smoothing algorithm was applied to this image
--	-------------	--

	Score: 2	Subjective Comments: Slightly better than rank #3 and slightly worse than rank #1 noise more apparent than #1.
---	-------------	--

	Score: 3	Subjective Comments: <p>This image has the most amount of noise as is evidenced by the graniness</p>
---	-------------	---

	Score: 2	Subjective Comments: <p>Noise is apparent here (more than image rank #1) but less than image rank #3</p>
--	-------------	---

	Score: 1	Subjective Comments: <p>Can see the portal vein extending in the liver the best. Least amount of noise than the other 2</p>
---	-------------	--



Score:

1

Subjective Comments:

The lesions in the spleen (whether they are true lesions or related to perfusion phenomena) are best apparent on this image. Therefore contrast resolution is best here. Images also appear brightest



Score:

2

Subjective Comments:

Can see the splenic lesions but less clear than #1

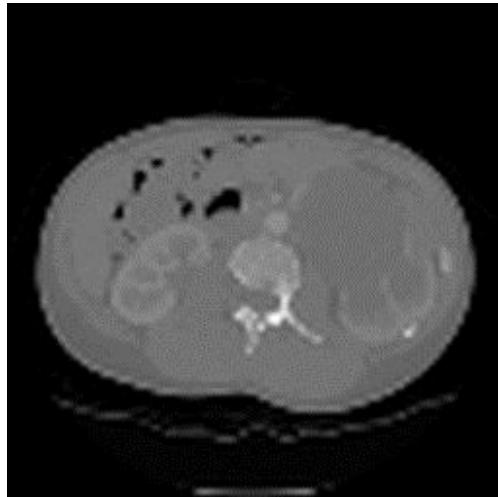


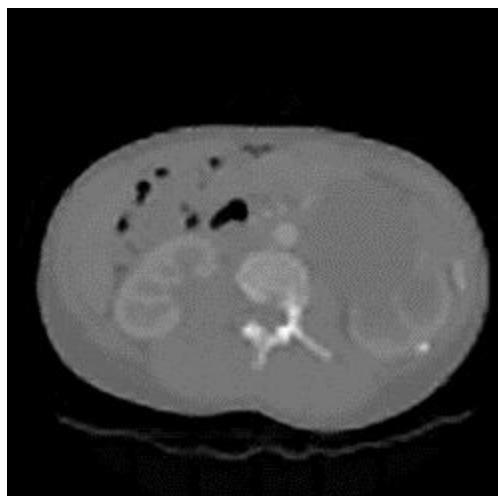
Score:

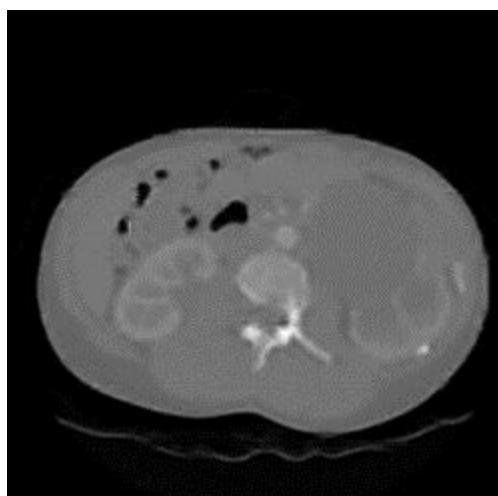
3

Subjective Comments:

Most difficult to appreciate the splenic lesions

	Score: 1	Subjective Comments: This appears to have least amount of noise
---	-------------	--

	Score: 3	Subjective Comments: Margins are the most blurry (noisy) in this image
--	-------------	---

	Score: 2	Subjective Comments: Margins slightly less sharp than rank #1
---	-------------	--

Mean Opinion Score Survey

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1	High Quality
2	Medium Quality
3	Lowest Quality

LING ZHUANG

Printed Name

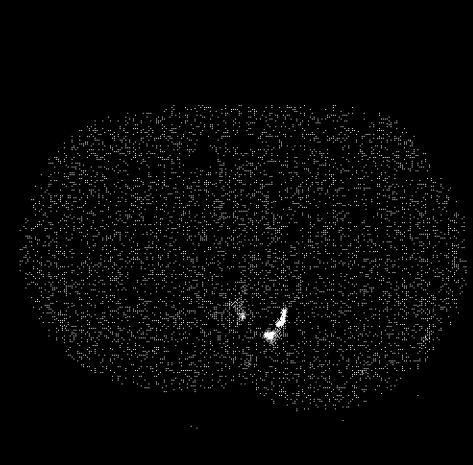
Northwestern Medicine

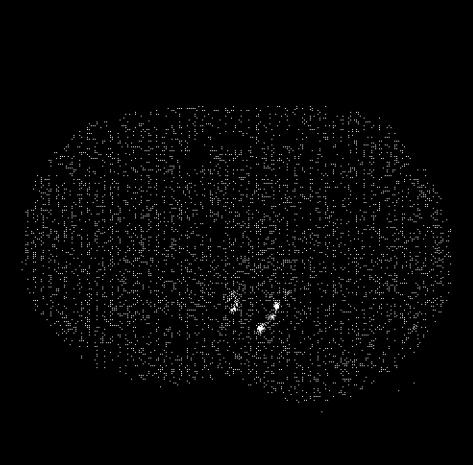
Institution

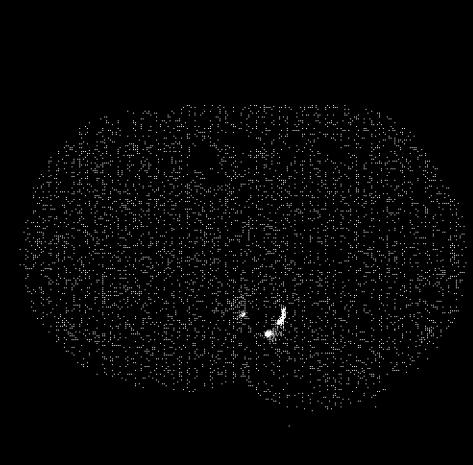
[Signature]

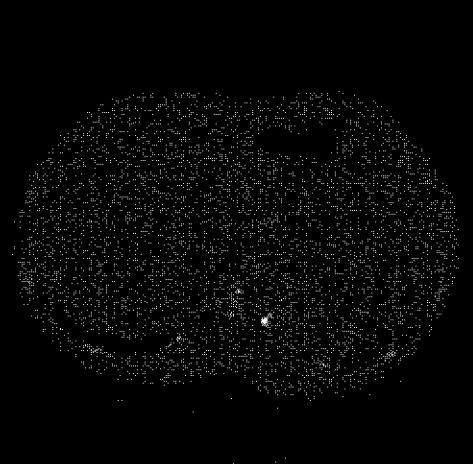
Signature

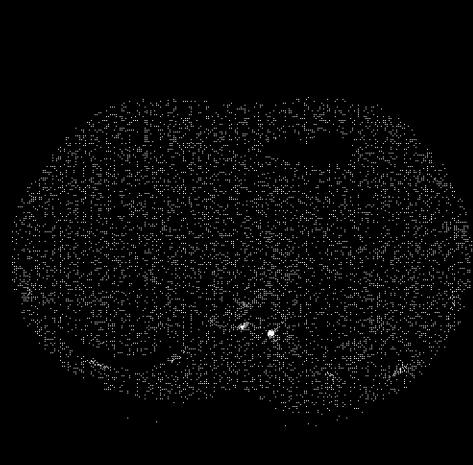
[1] Dong, Chao, et al. "Image super-resolution using deep convolutional networks." *IEEE transactions on pattern analysis and machine intelligence* 38.2 (2016): 295-307.

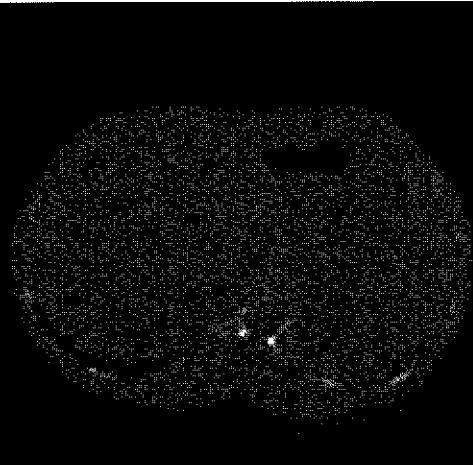
	Score:	Subjective Comments:
		3

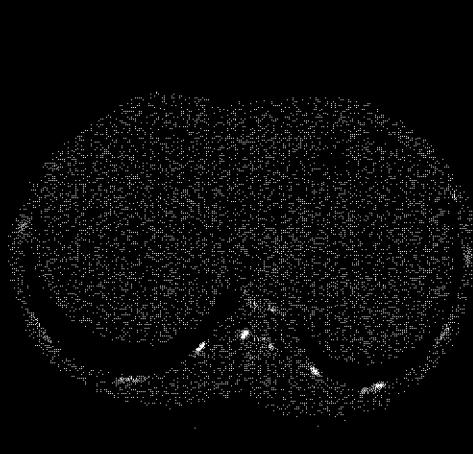
	Score:	Subjective Comments:
		1

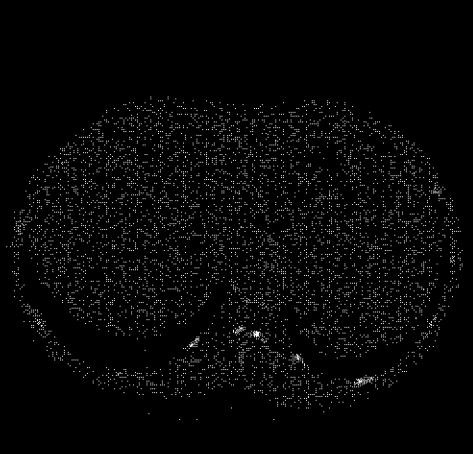
	Score:	Subjective Comments:
		2

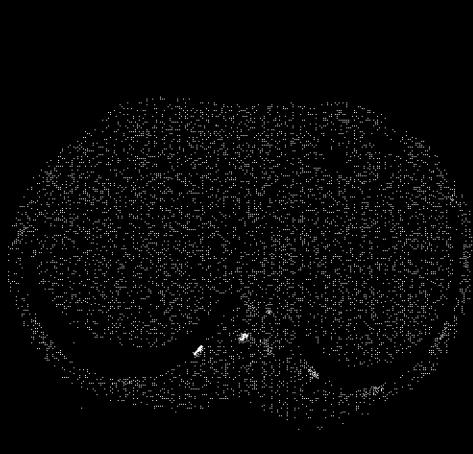
	Score:	Subjective Comments:
		3

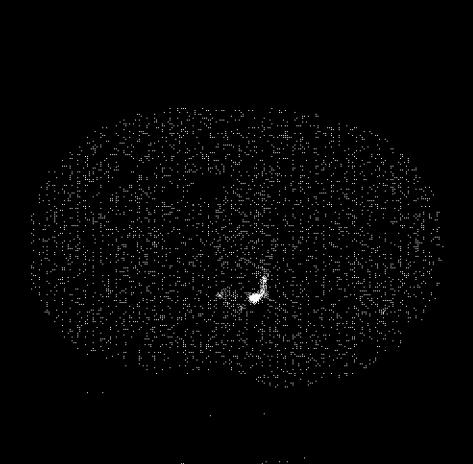
	Score:	Subjective Comments:
		1

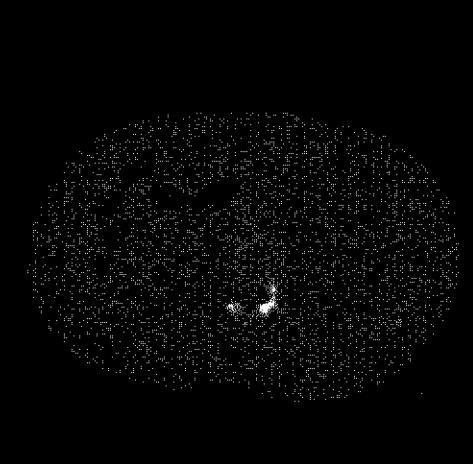
	Score:	Subjective Comments:
		2

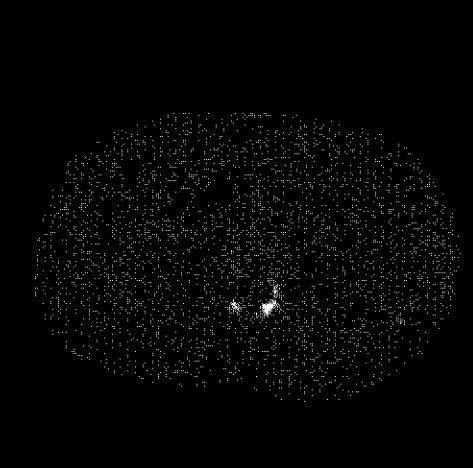
	Score:	Subjective Comments:
		3

	Score:	Subjective Comments:
		1

	Score:	Subjective Comments:
		2

	Score:	Subjective Comments:
		1

	Score:	Subjective Comments:
		3

	Score:	Subjective Comments:
		2

Mean Opinion Score Survey

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1	High Quality
2	Medium Quality
3	Lowest Quality

Printed Name

Dr. Ninad Shah

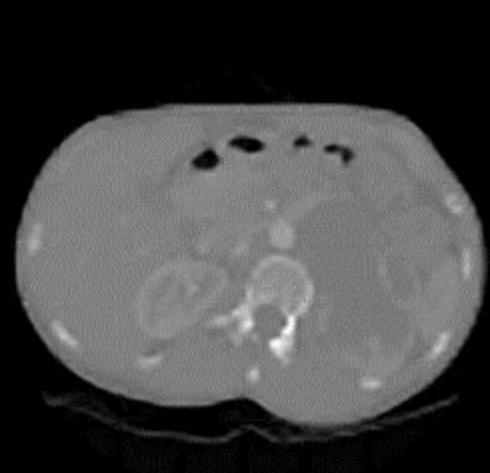
Institution

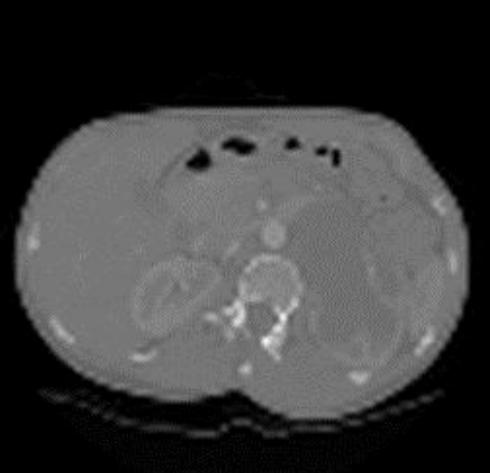
Rays X-ray and Sonography Clinic

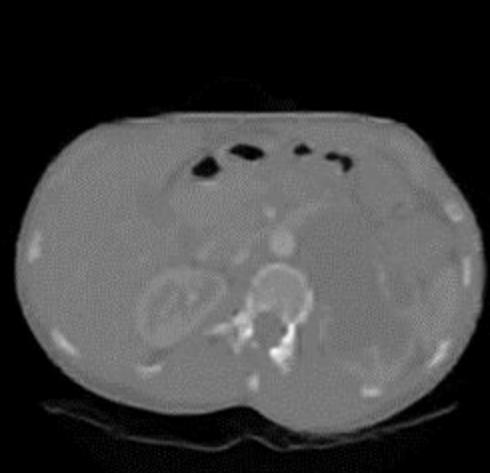
Signature

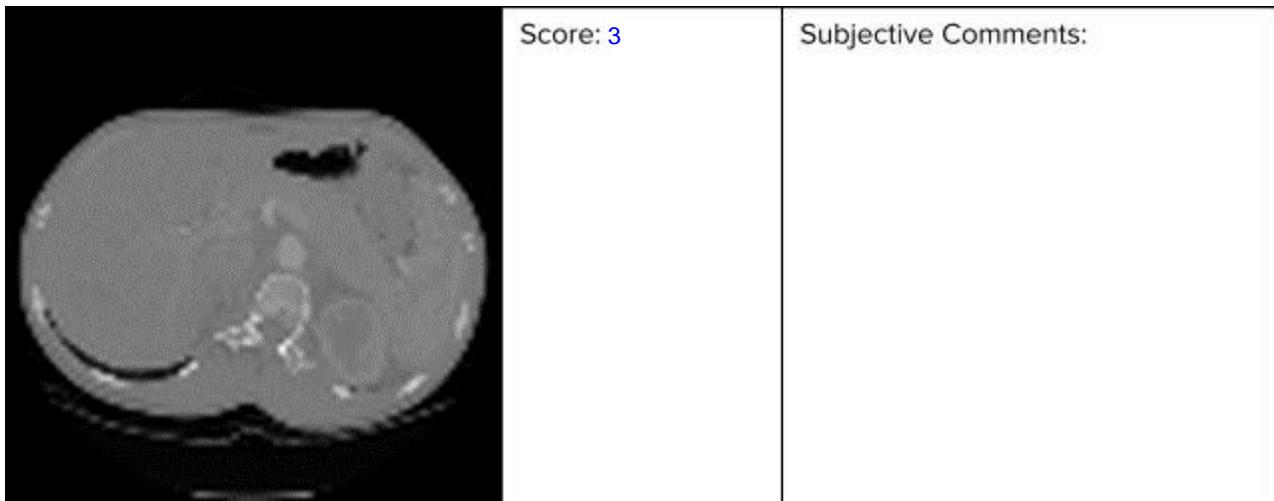


[1] Dong, Chao, et al. "Image super-resolution using deep convolutional networks." *IEEE transactions on pattern analysis and machine intelligence* 38.2 (2016): 295-307.

	Score: 1	Subjective Comments: Overall resolution, sharpness, contrast and clarity are best among the three
---	-------------	--

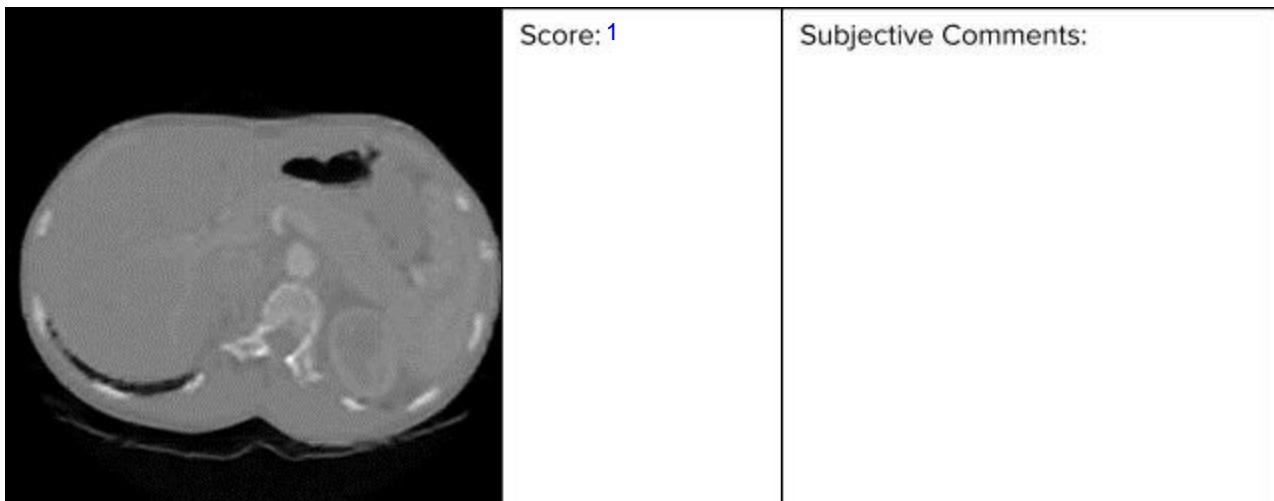
	Score: 3	Subjective Comments: Resolution is worst among the 3
--	----------	---

	Score: 2	Subjective Comments: Closer to the first image, but the first image looks better overall
---	----------	---



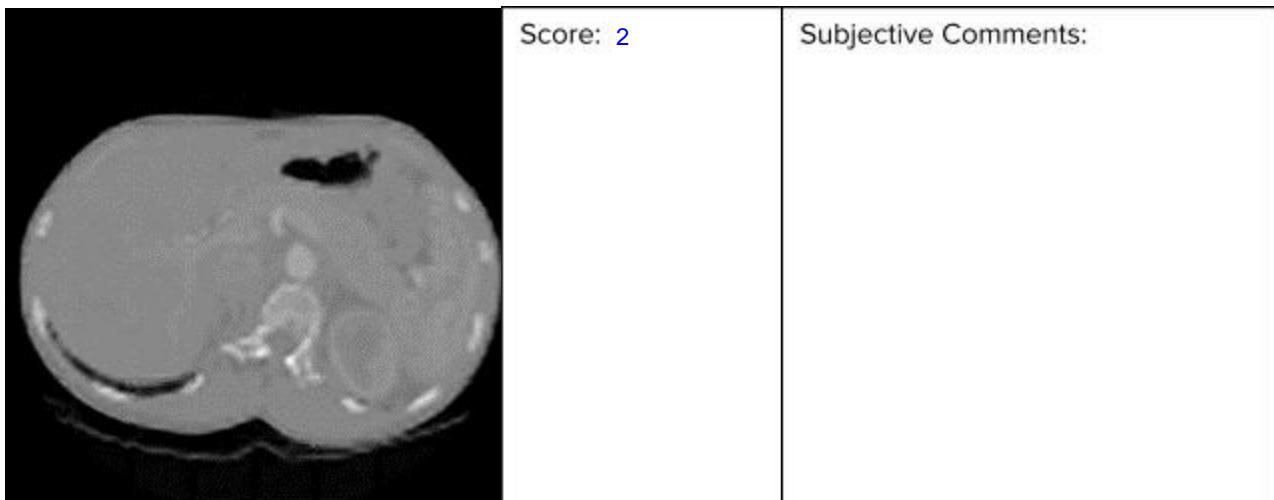
Score: 3

Subjective Comments:



Score: 1

Subjective Comments:



Score: 2

Subjective Comments:



Score: 1

Subjective Comments:



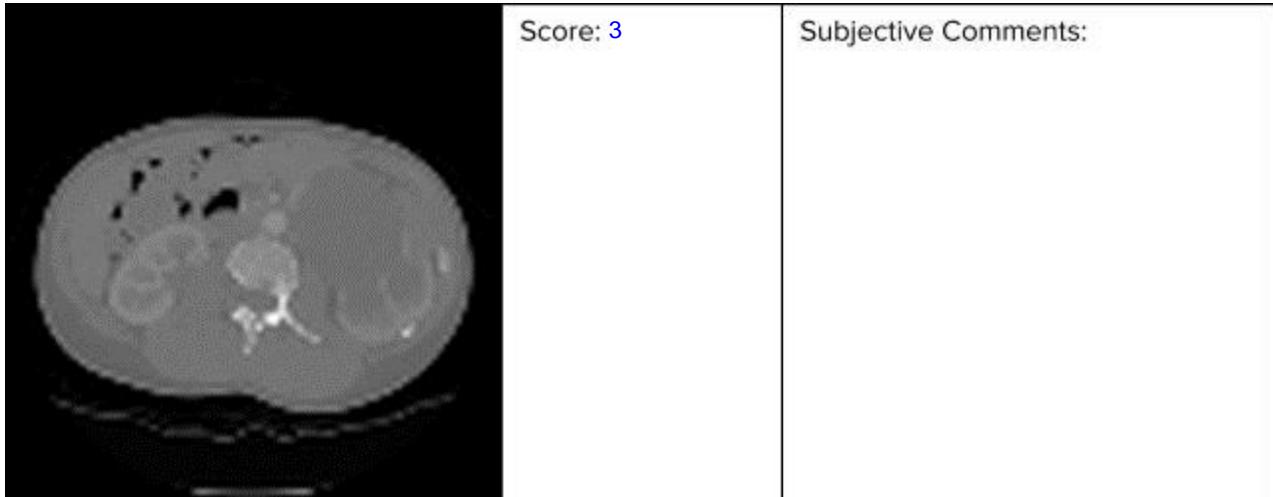
Score: 3

Subjective Comments:



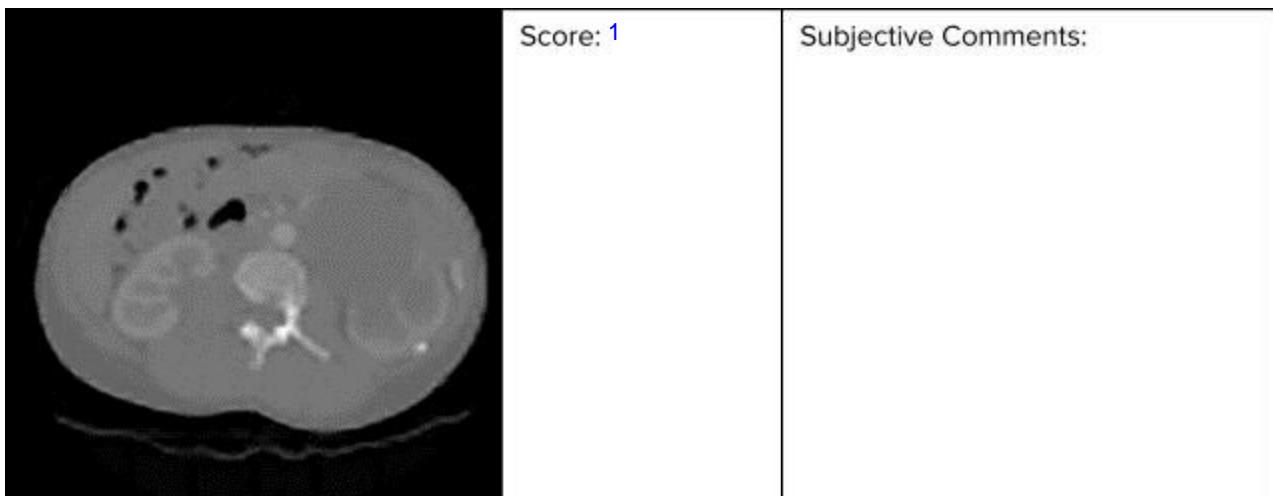
Score: 2

Subjective Comments:



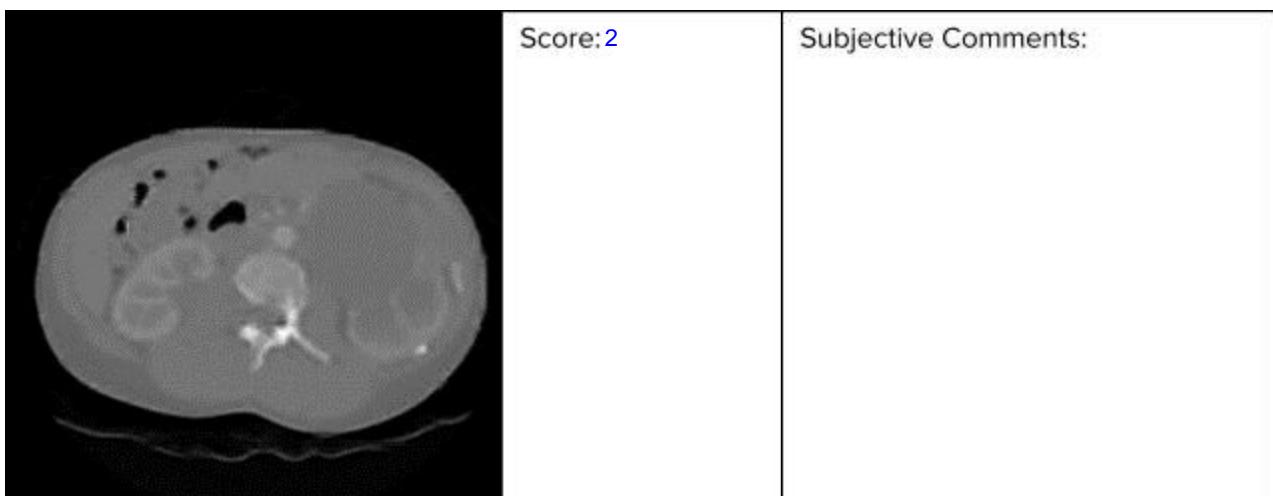
Score: 3

Subjective Comments:



Score: 1

Subjective Comments:



Score: 2

Subjective Comments: