
Using Neural Convolutional Networks to Recognize Rhythm Stimuli from Electroencephalography Recordings – Supplementary Material –

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Table 1: Structural parameters and performance values of the best CNNs with one and two convolutional layers after Bayesian parameter optimization for each subject (500 runs) and the three subject groups (100 runs). Layer structure is written as [kernel shape] / pooling width x number of channels. For each subject or group, the * marks the CNN with the better accuracy.

subject	input	network structure		channel mean (24 classes)			aggregated trial accuracy				
		1st layer	2nd layer	accuracy	prec.@3	MRR	24 classes	12 classes	4 classes	2 classes	
1		33x49	[27x49]/1x29		18.4%	38.5%	0.35	20.8%	29.2%	37.5%	62.5%
	*	33x49	[5x49]/3x16	[16x1]/5x12	19.1%	36.1%	0.34	25.0%	29.2%	58.3%	79.2%
2		33x49	[10x49]/1x22		27.1%	46.5%	0.42	37.5%	37.5%	50.0%	87.5%
	*	33x49	[5x49]/1x25	[13x1]/8x30	26.4%	43.8%	0.41	33.3%	33.3%	50.0%	87.5%
3		33x49	[17x49]/1x30		21.9%	38.2%	0.36	20.8%	25.0%	45.8%	66.7%
	*	33x49	[4x49]/2x23	[12x1]/1x22	19.8%	33.3%	0.33	20.8%	20.8%	29.2%	45.8%
4		45x49	[35x49]/1x30		36.1%	63.5%	0.55	50.0%	62.5%	75.0%	83.3%
	*	45x49	[28x49]/1x25	[1x1]/3x24	35.8%	58.7%	0.53	41.7%	58.3%	70.8%	87.5%
5		45x49	[40x49]/2x30		18.1%	34.7%	0.33	16.7%	25.0%	41.7%	70.8%
	*	45x49	[3x49]/10x5	[11x1]/8x11	17.7%	36.5%	0.34	16.7%	25.0%	41.7%	70.8%
6		45x49	[39x49]/1x30		27.6%	51.3%	0.44	37.5%	41.7%	62.5%	83.3%
	*	45x49	[26x49]/5x30	[1x1]/10x30	29.5%	48.1%	0.45	37.5%	41.7%	54.2%	75.0%
7		33x49	[15x49]/1x13		23.1%	43.9%	0.40	33.3%	45.8%	54.2%	66.7%
	*	33x49	[1x49]/1x10	[1x1]/5x30	21.8%	36.2%	0.36	25.0%	29.2%	45.8%	70.8%
8		33x49	[2x49]/1x30		23.4%	46.2%	0.39	29.2%	33.3%	45.8%	66.7%
	*	33x49	[5x49]/2x21	[2x1]/2x24	24.0%	44.2%	0.41	41.7%	41.7%	58.3%	91.7%
9		33x49	[27x49]/1x14		20.8%	40.4%	0.38	33.3%	41.7%	66.7%	95.8%
	*	33x49	[13x49]/2x21	[6x1]/4x30	21.8%	33.7%	0.36	25.0%	29.2%	58.3%	91.7%
10		45x49	[7x49]/1x30		26.6%	51.0%	0.44	33.3%	33.3%	45.8%	66.7%
	*	45x49	[6x49]/1x30	[1x1]/10x30	23.7%	51.6%	0.43	29.2%	29.2%	58.3%	75.0%
11		45x49	[27x49]/1x30		26.6%	55.1%	0.45	33.3%	37.5%	41.7%	75.0%
	*	45x49	[25x49]/1x22	[5x1]/2x23	26.0%	53.8%	0.44	33.3%	41.7%	50.0%	75.0%
12		45x49	[36x49]/3x30		27.9%	57.7%	0.47	37.5%	45.8%	58.3%	87.5%
	*	45x49	[5x49]/5x30	[5x1]/10x30	32.1%	60.9%	0.51	29.2%	33.3%	54.2%	83.3%
13		45x49	[27x49]/1x20		20.2%	35.6%	0.35	16.7%	16.7%	45.8%	58.3%
	*	45x49	[18x49]/10x21	[1x1]/6x30	20.2%	37.2%	0.36	25.0%	29.2%	50.0%	70.8%
mean (1 convolutional layer)					24.4%	46.4%	0.41	30.8%	36.5%	51.6%	74.7%
mean (2 convolutional layers)					24.4%	44.2%	0.40	29.5%	34.0%	52.2%	77.2%
fast		33x49	[8x49]/1x22		9.7%	22.1%	0.23	10.4%	16.7%	35.4%	66.7%
	*	33x49	[1x49]/1x30	[17x1]/1x30	9.5%	21.6%	0.23	11.8%	19.4%	38.9%	67.4%
slow		45x49	[31x49]/1x30		9.9%	22.9%	0.24	10.7%	13.7%	32.7%	56.5%
	*	45x49	[1x49]/10x23	[12x1]/5x27	9.1%	24.3%	0.24	10.1%	13.1%	31.5%	58.9%
all		33x49	[1x49]/1x30		7.3%	19.0%	0.21	7.7%	12.2%	29.2%	57.1%
	*	33x49	[3x49]/9x22	[5x1]/5x18	7.2%	18.4%	0.20	8.7%	12.5%	31.4%	55.4%

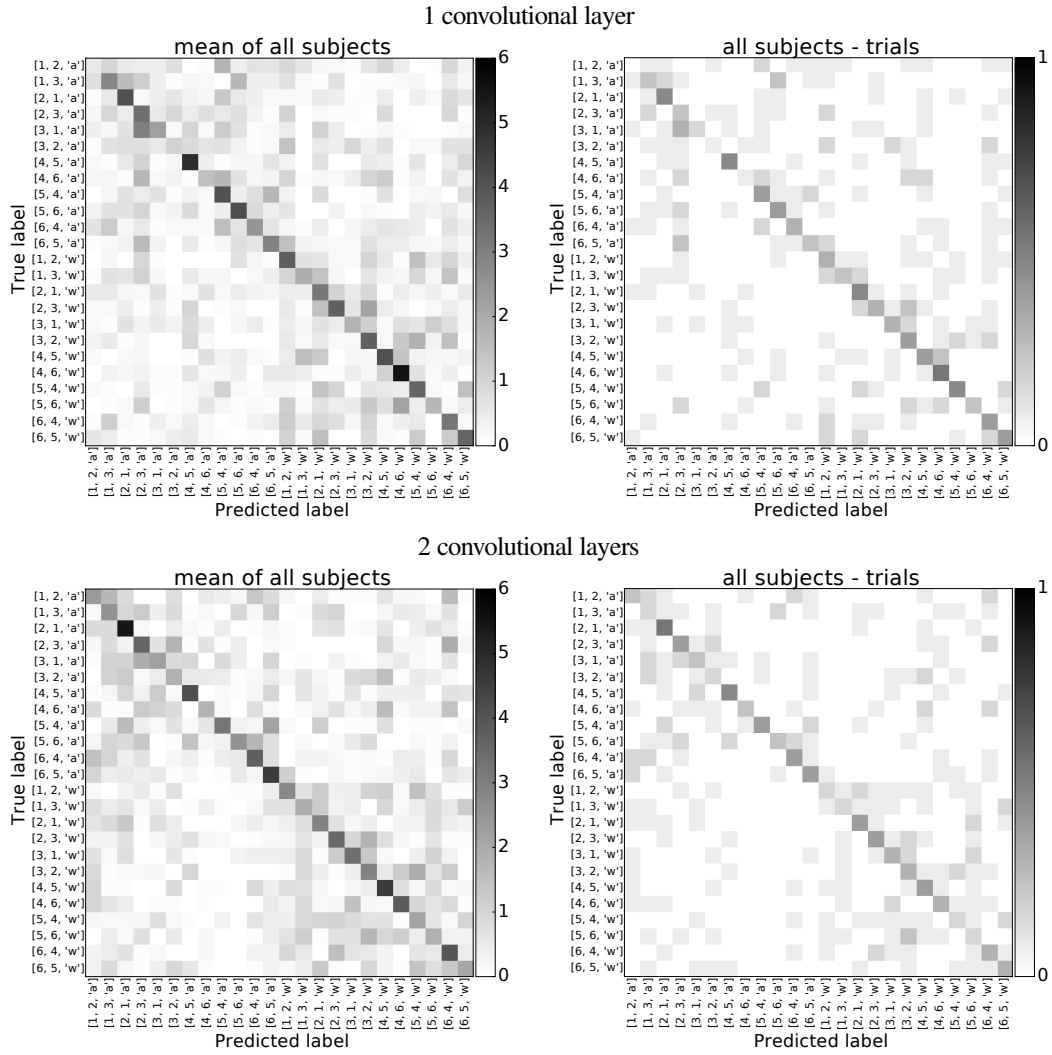
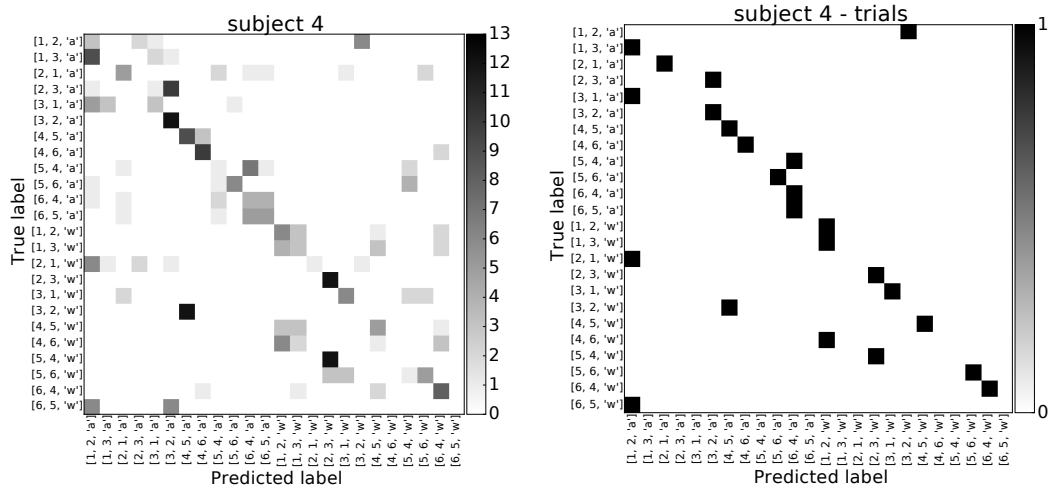


Figure 1: Mean confusion matrices for all subjects.

1 convolutional layer



2 convolutional layers

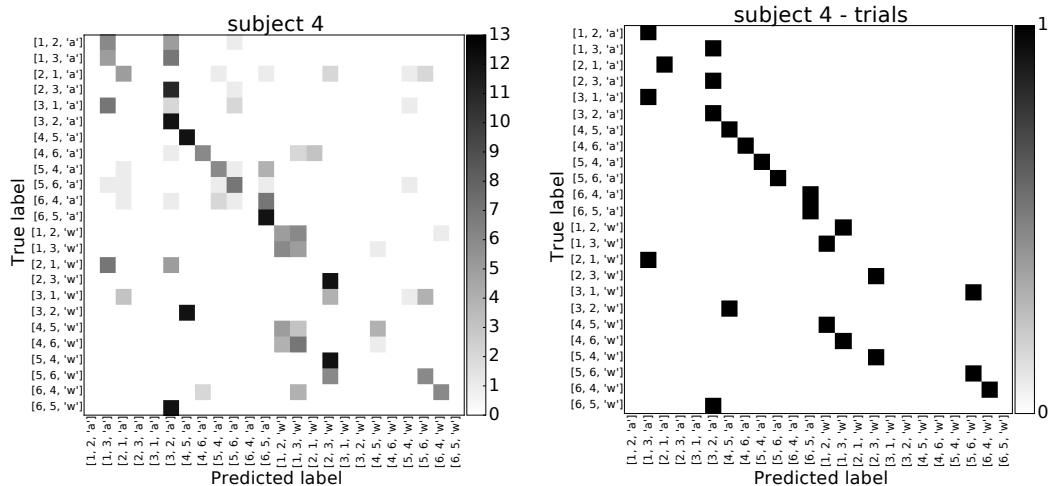


Figure 2: Confusion matrices for the best found models for subject 4.

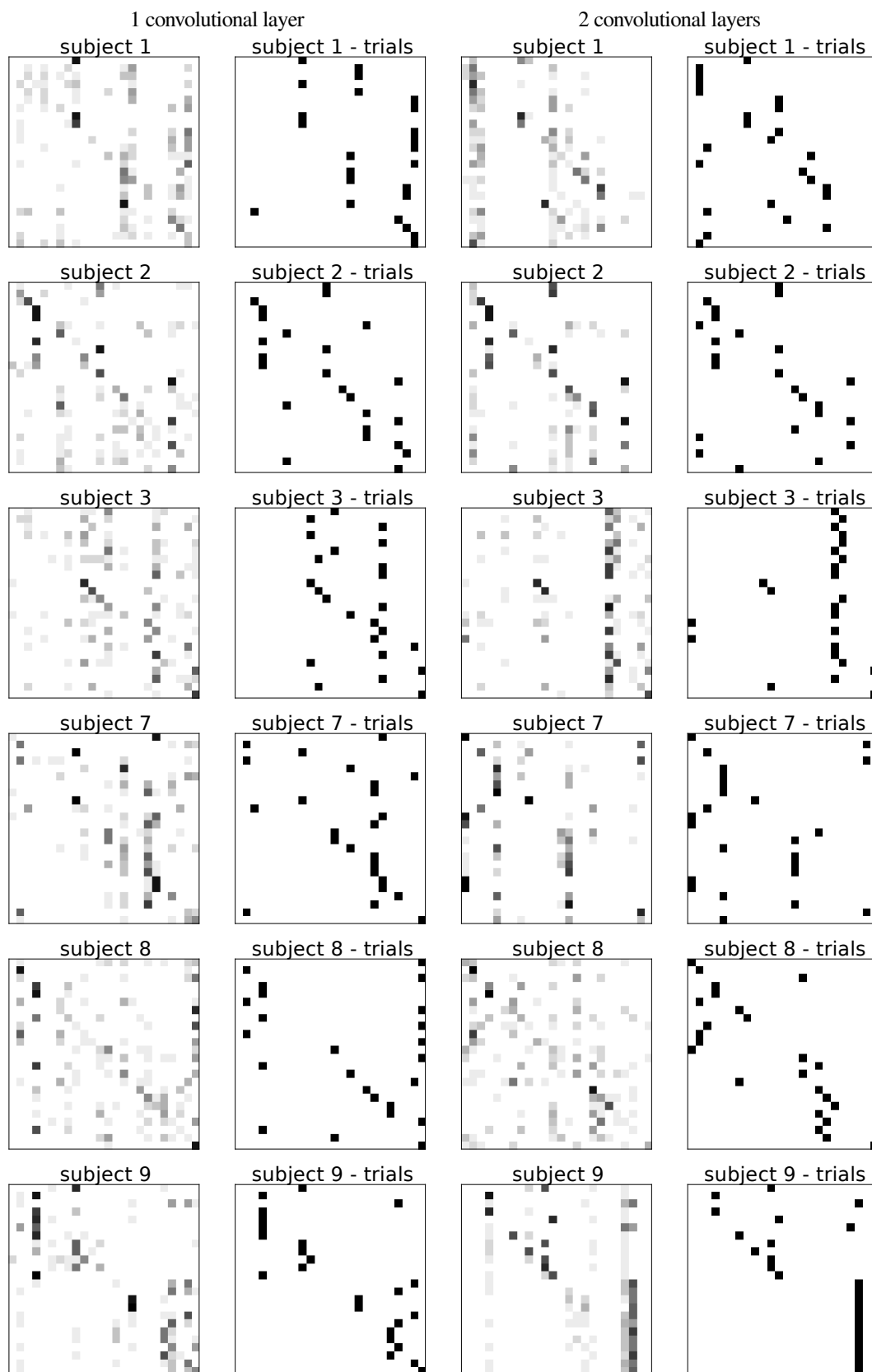


Figure 3: Confusion matrices for the best found models for the fast tempo group.

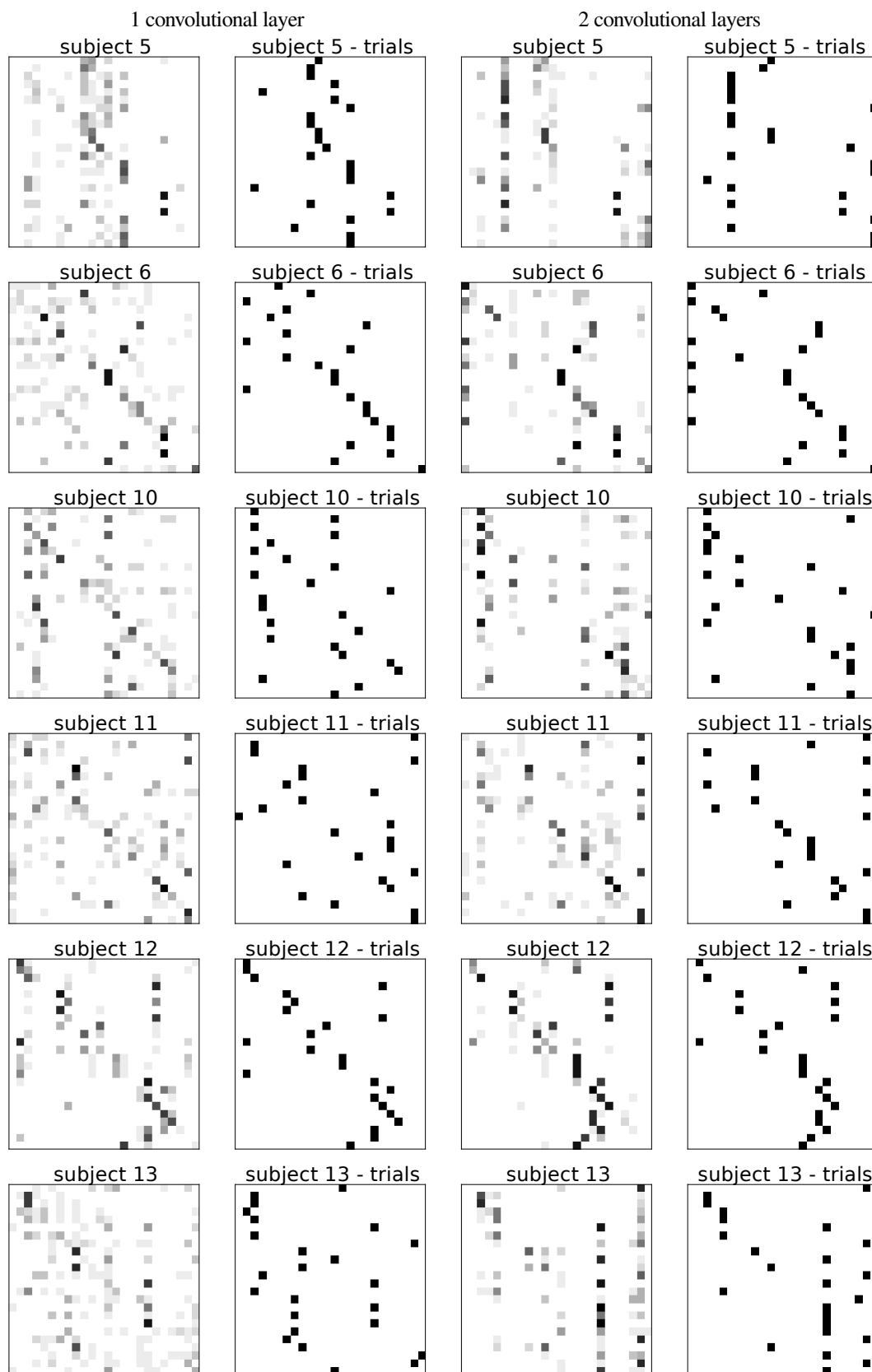


Figure 4: Confusion matrices for the best found models for the slow tempo group except subject 4.

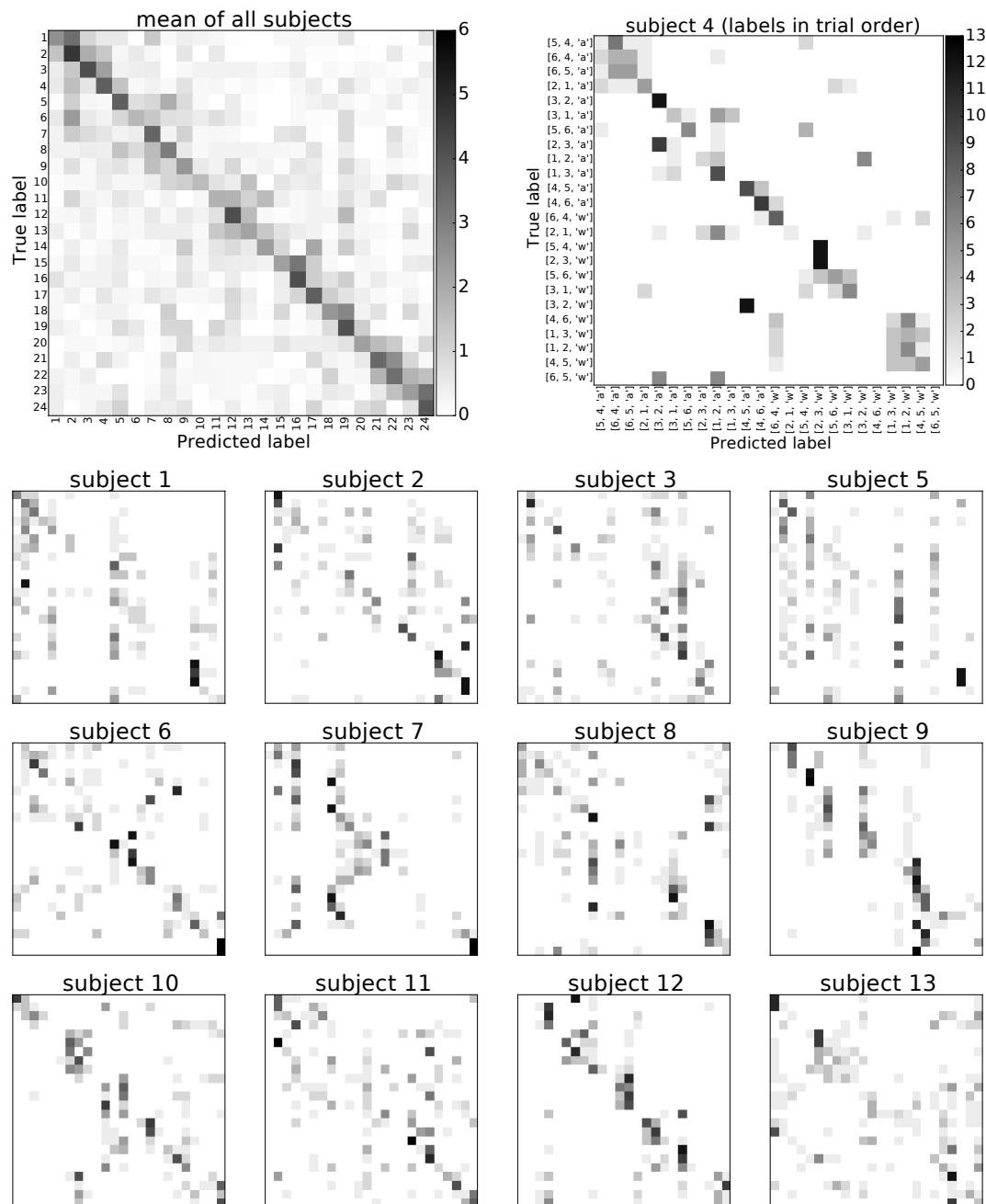


Figure 5: Confusion matrices with labels in trial order (i.e., different for each subjects) for the best found models with one convolutional layer.

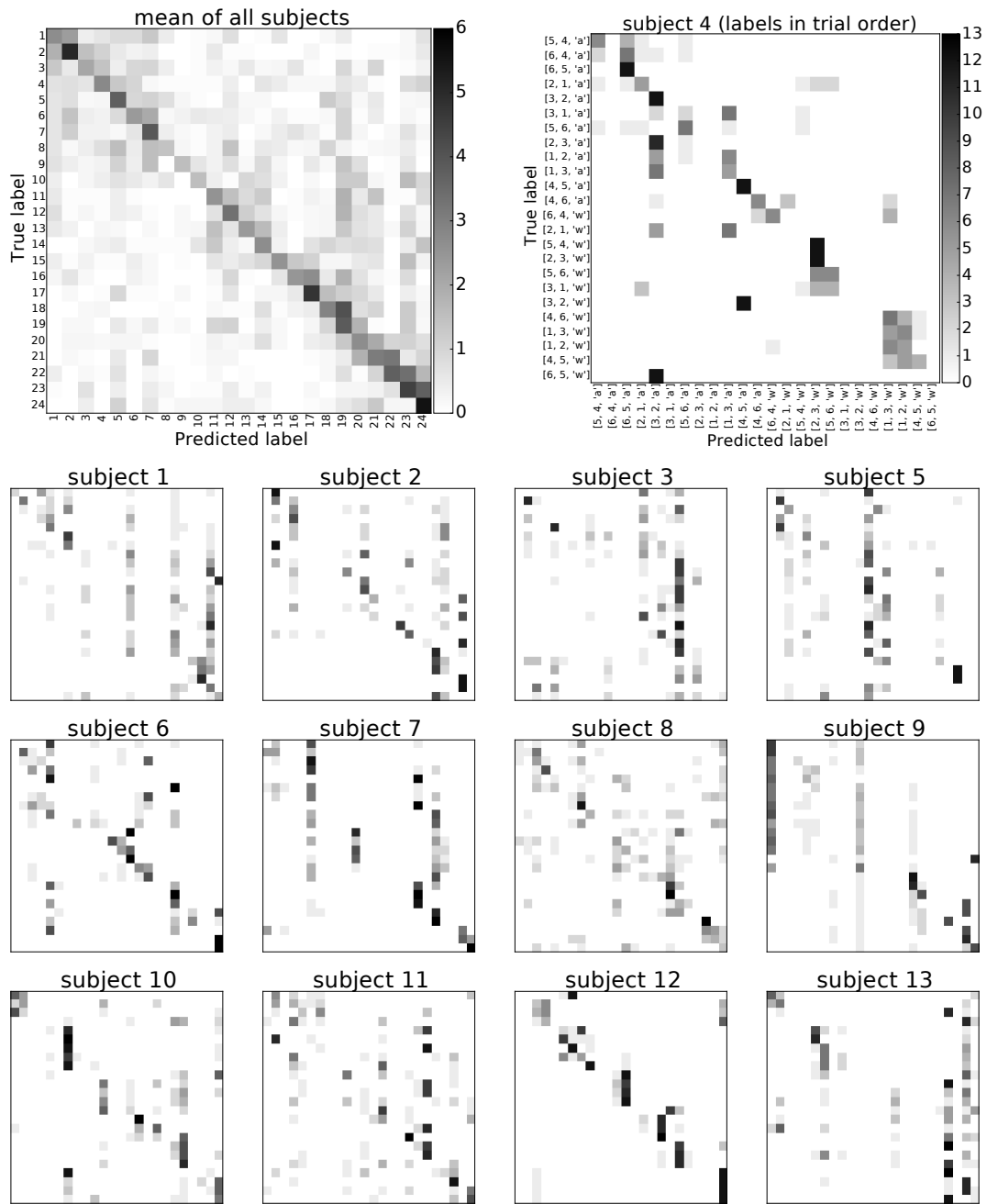


Figure 6: Confusion matrices with labels in trial order (i.e., different for each subjects) for the best found models with two convolutional layers.

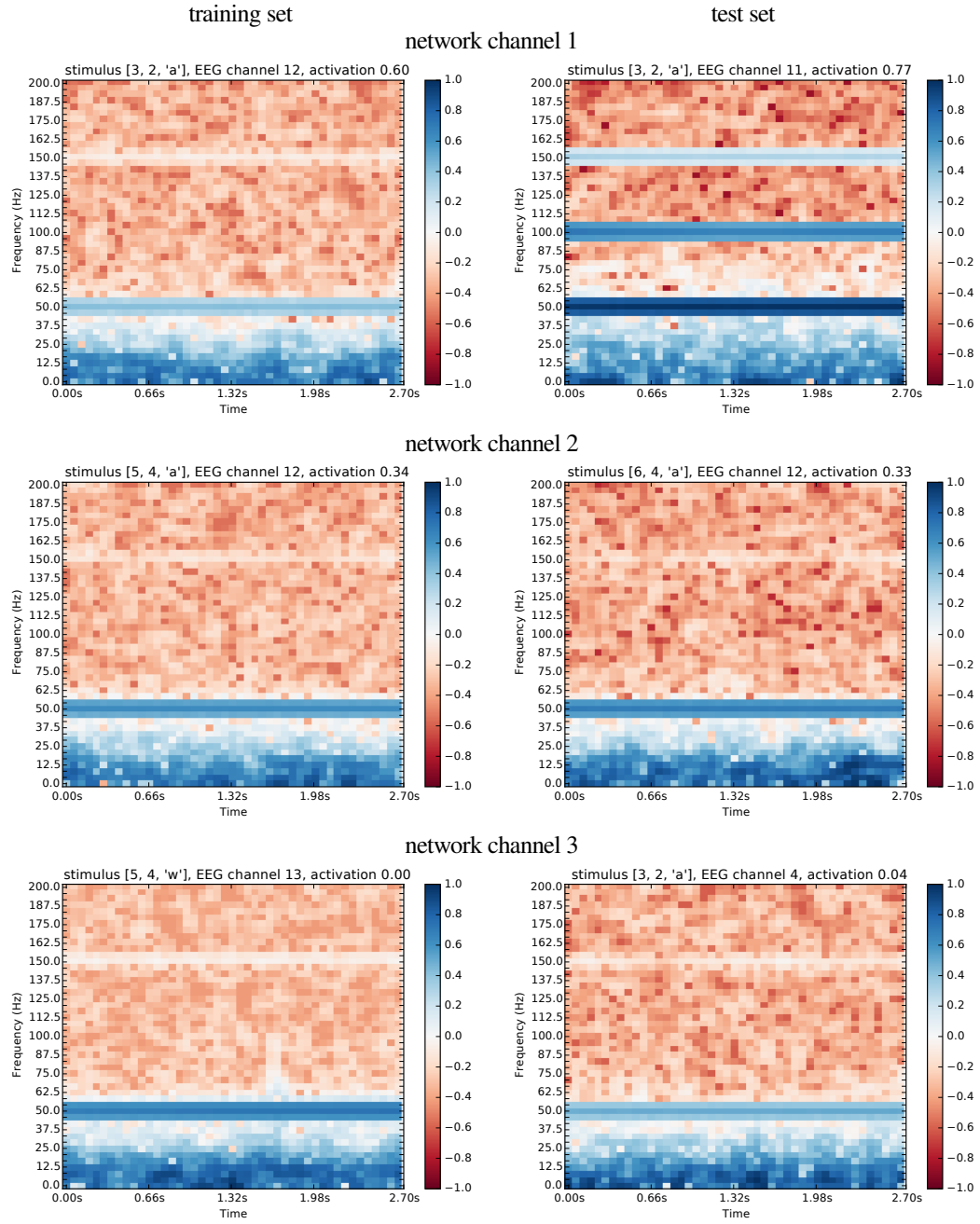


Figure 7: Inputs producing maximum activations for channels 1–3 in the CNN with a single convolutional layer for subject 4.

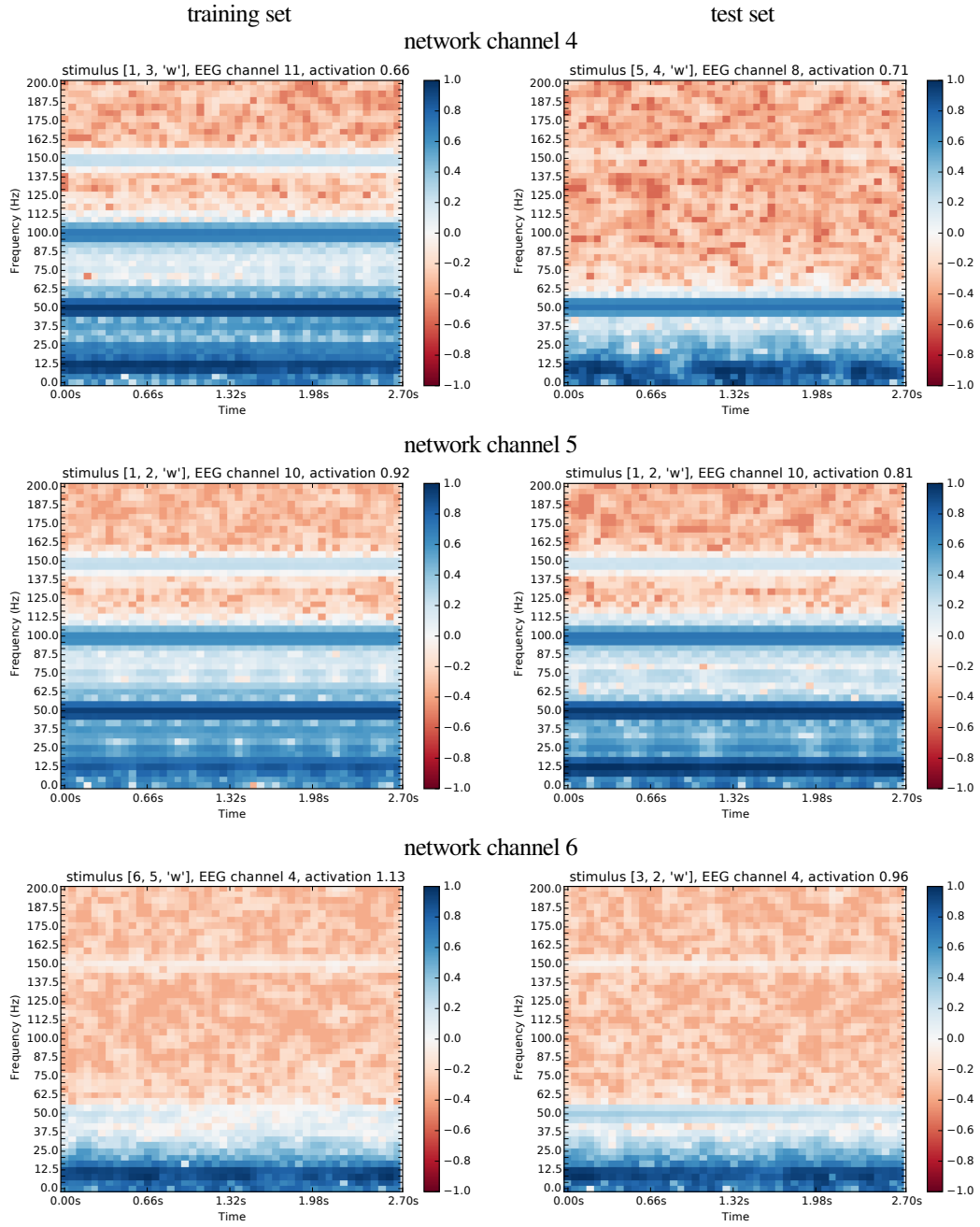


Figure 8: Inputs producing maximum activations for channels 4–6 in the CNN with a single convolutional layer for subject 4.

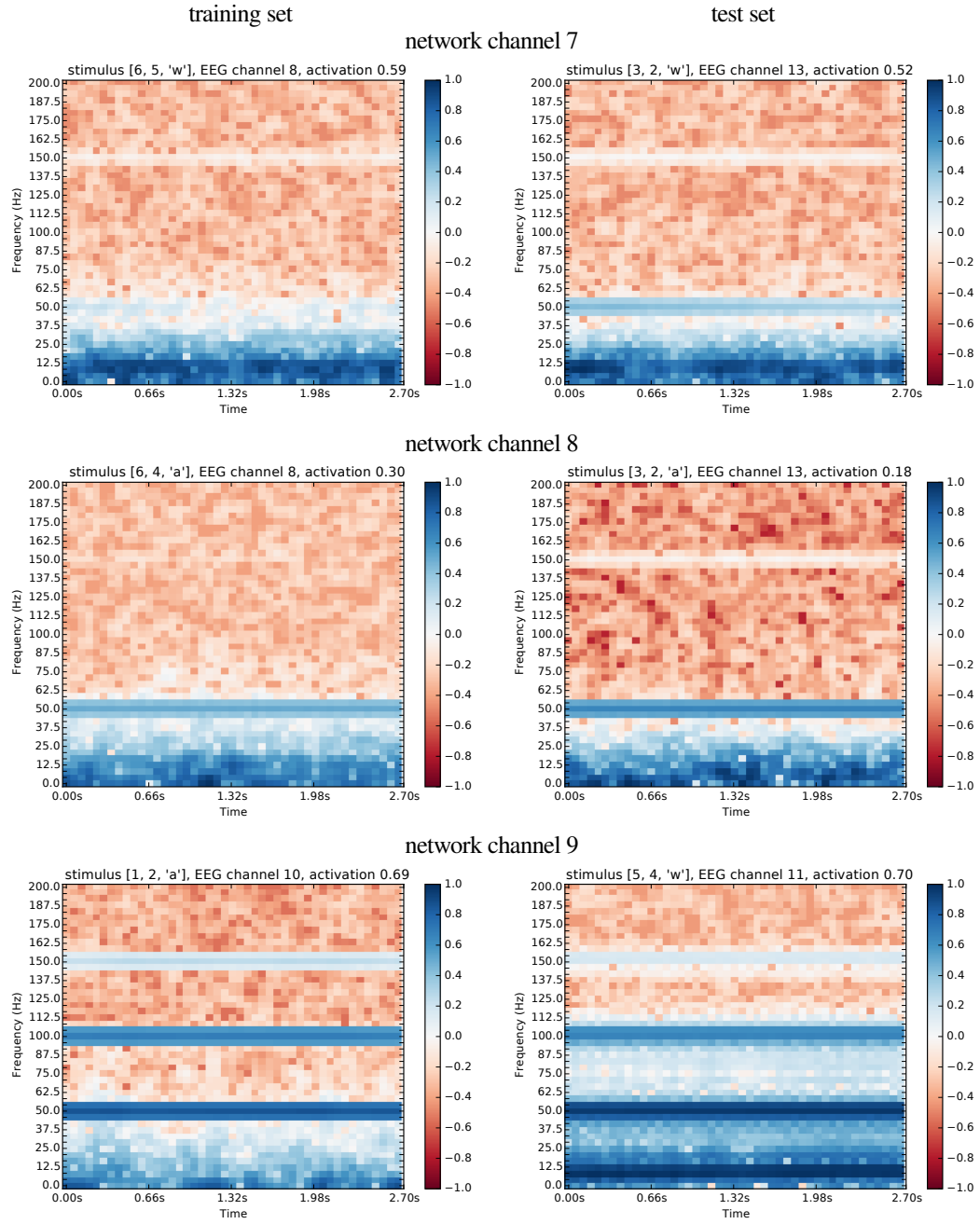


Figure 9: Inputs producing maximum activations for channels 7–9 in the CNN with a single convolutional layer for subject 4.

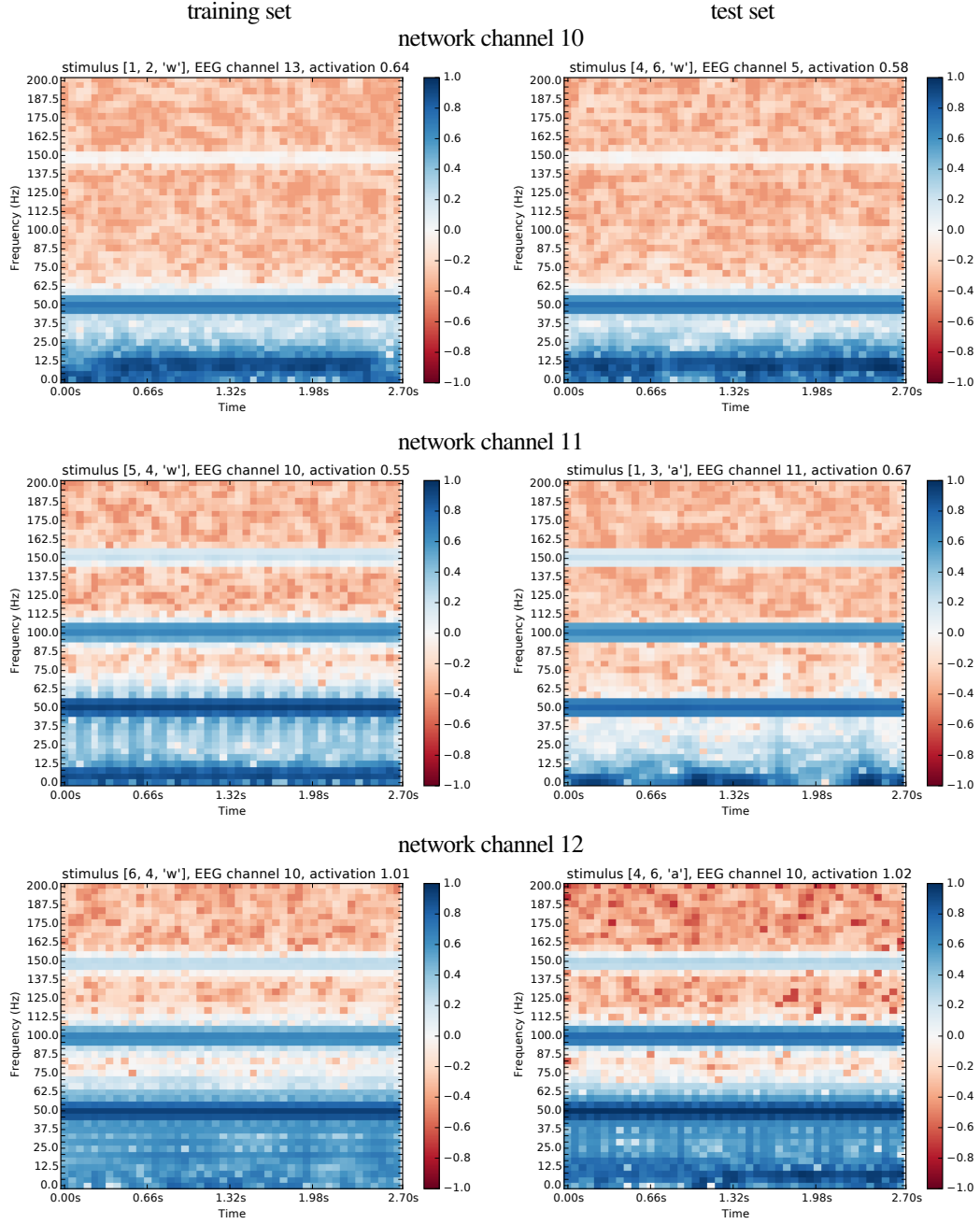


Figure 10: Inputs producing maximum activations for channels 10–12 in the CNN with a single convolutional layer for subject 4.

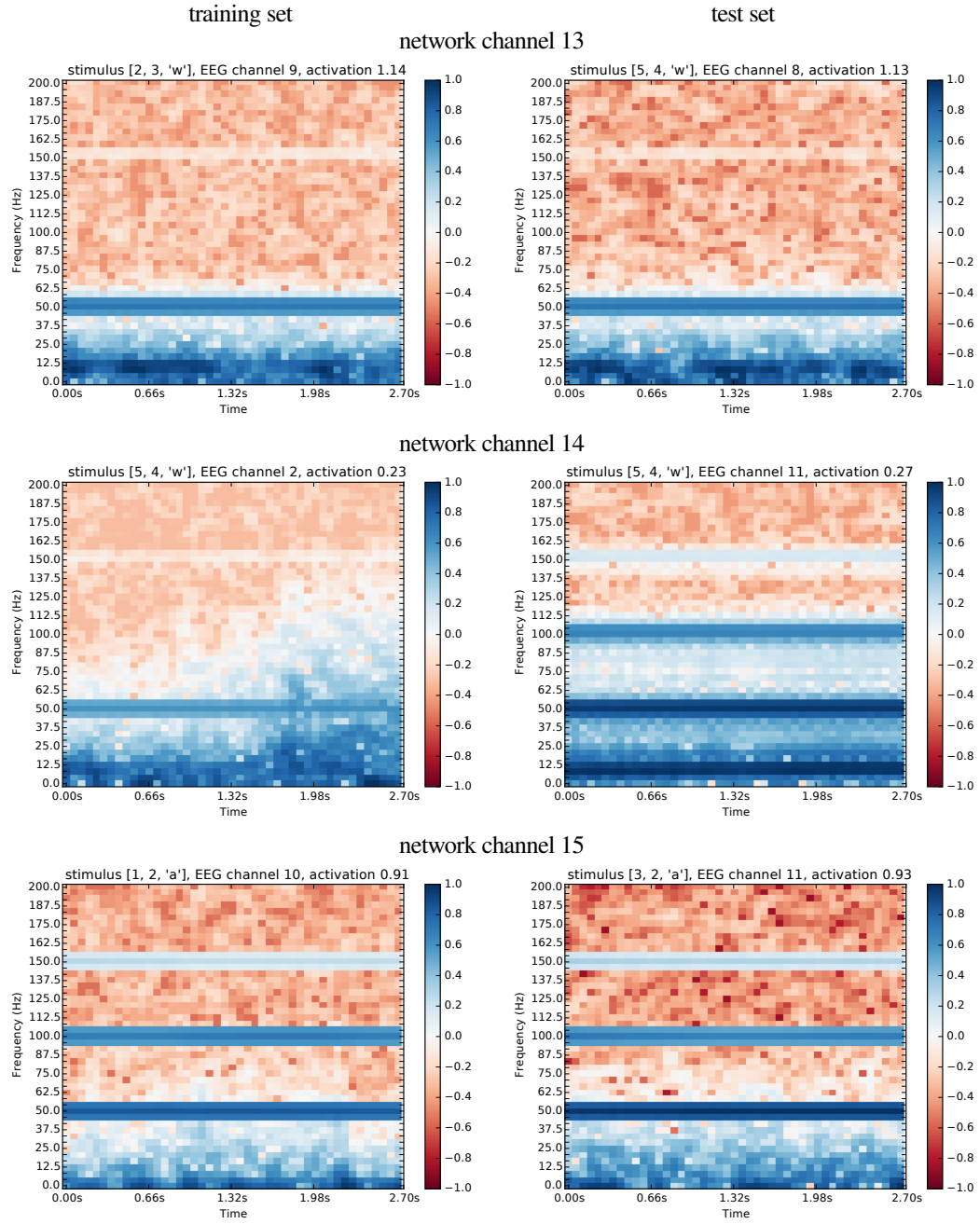


Figure 11: Inputs producing maximum activations for channels 13–15 in the CNN with a single convolutional layer for subject 4.

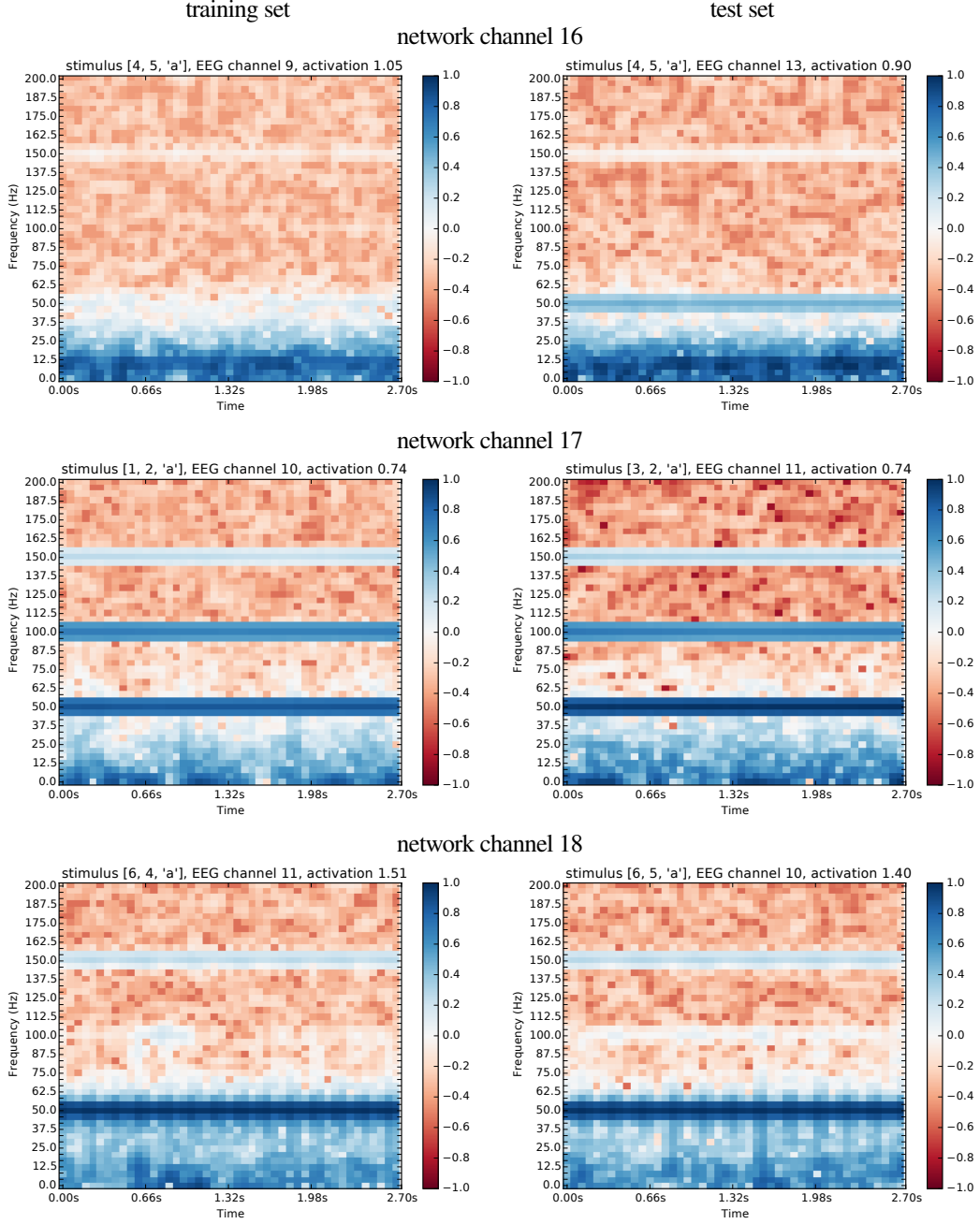


Figure 12: Inputs producing maximum activations for channels 16–18 in the CNN with a single convolutional layer for subject 4.

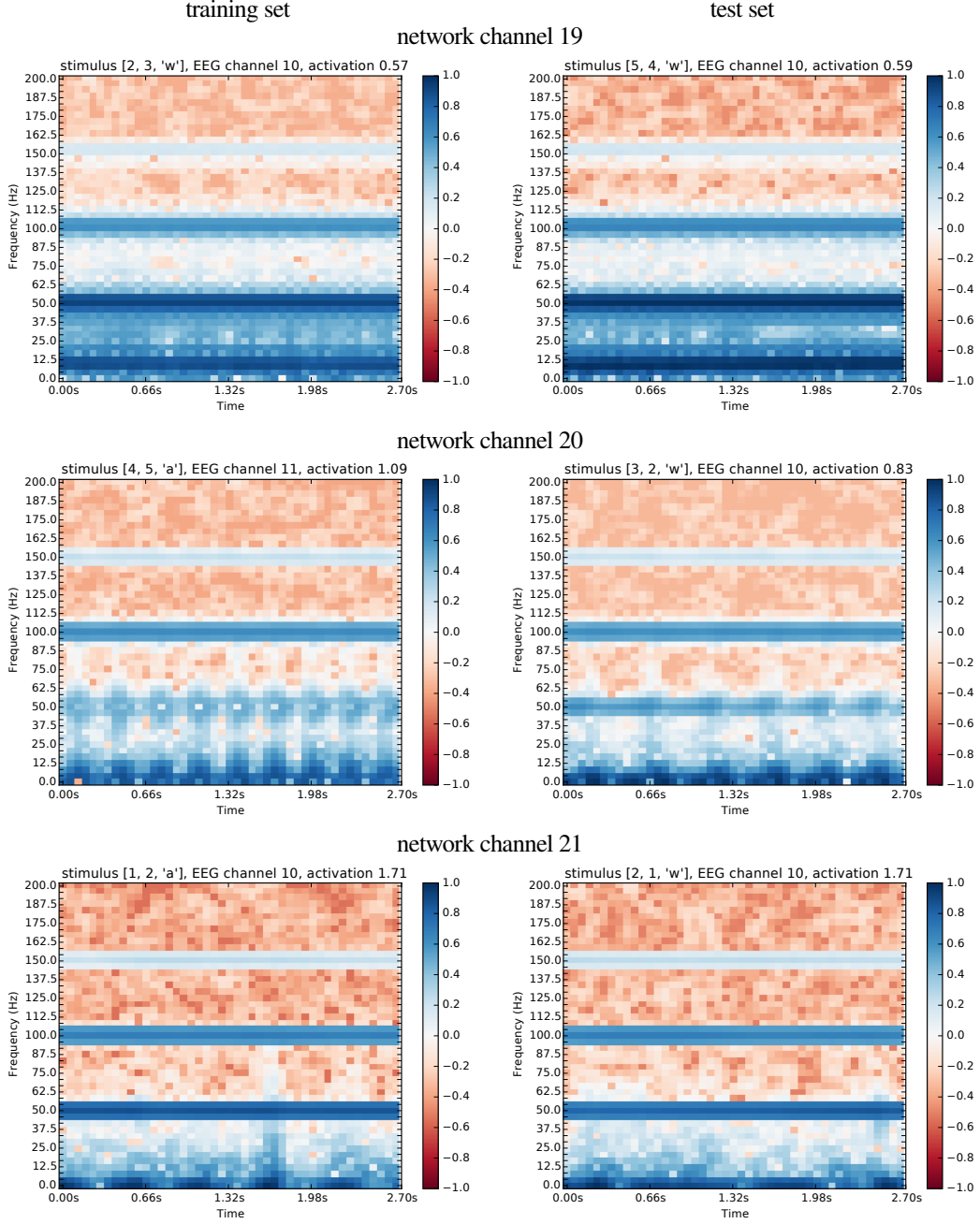


Figure 13: Inputs producing maximum activations for channels 19–21 in the CNN with a single convolutional layer for subject 4.

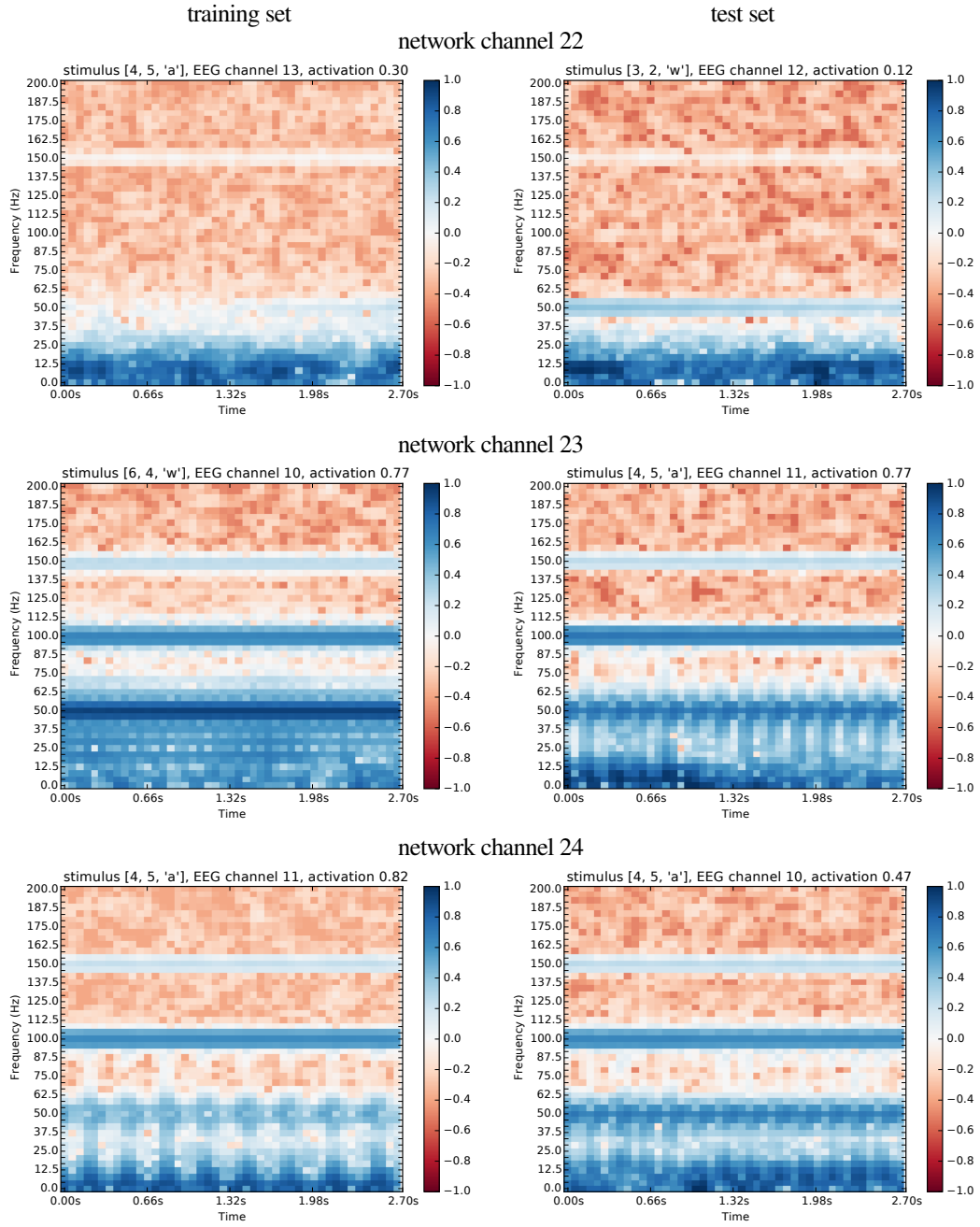


Figure 14: Inputs producing maximum activations for channels 22–24 in the CNN with a single convolutional layer for subject 4.

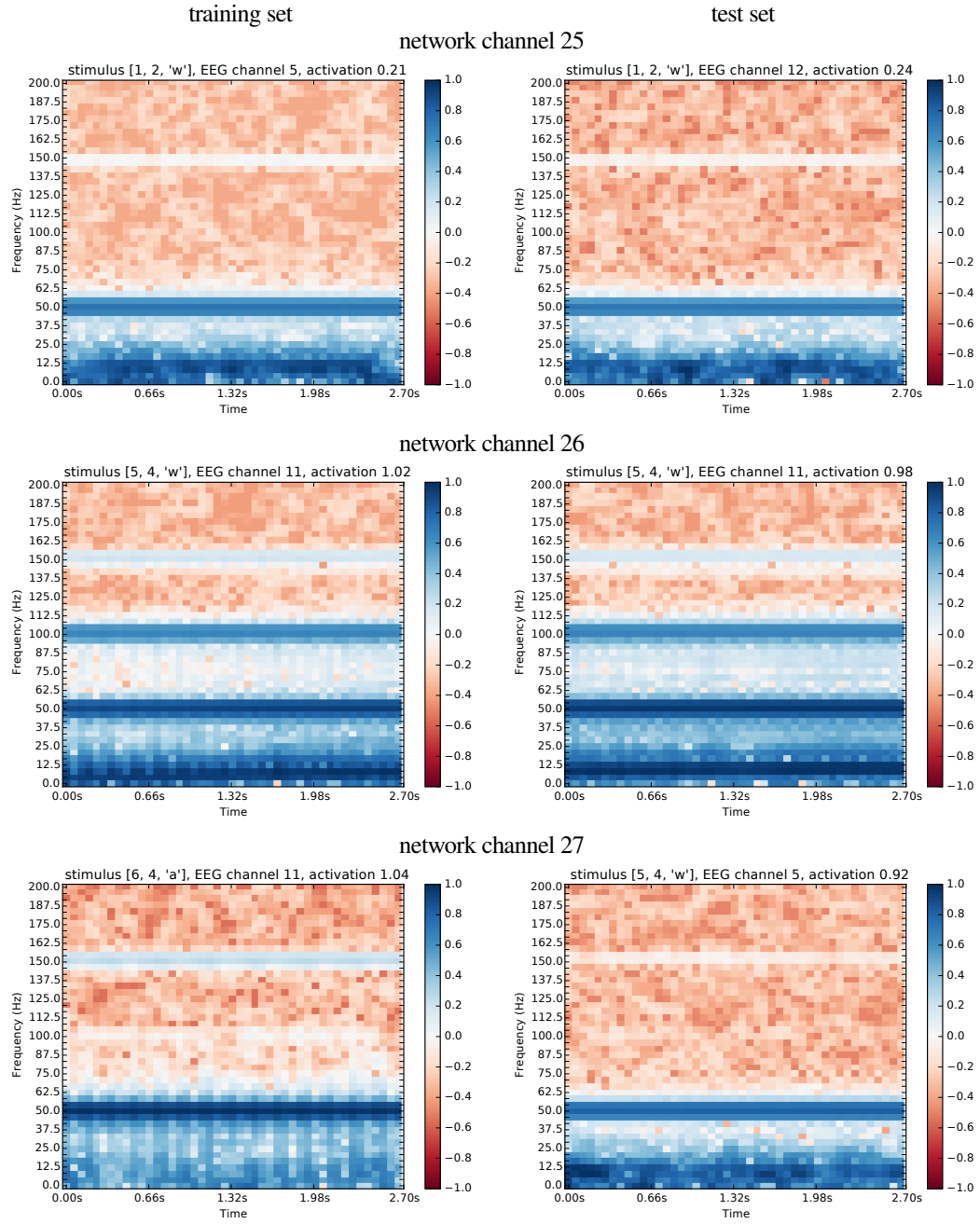


Figure 15: Inputs producing maximum activations for channels 25–27 in the CNN with a single convolutional layer for subject 4.

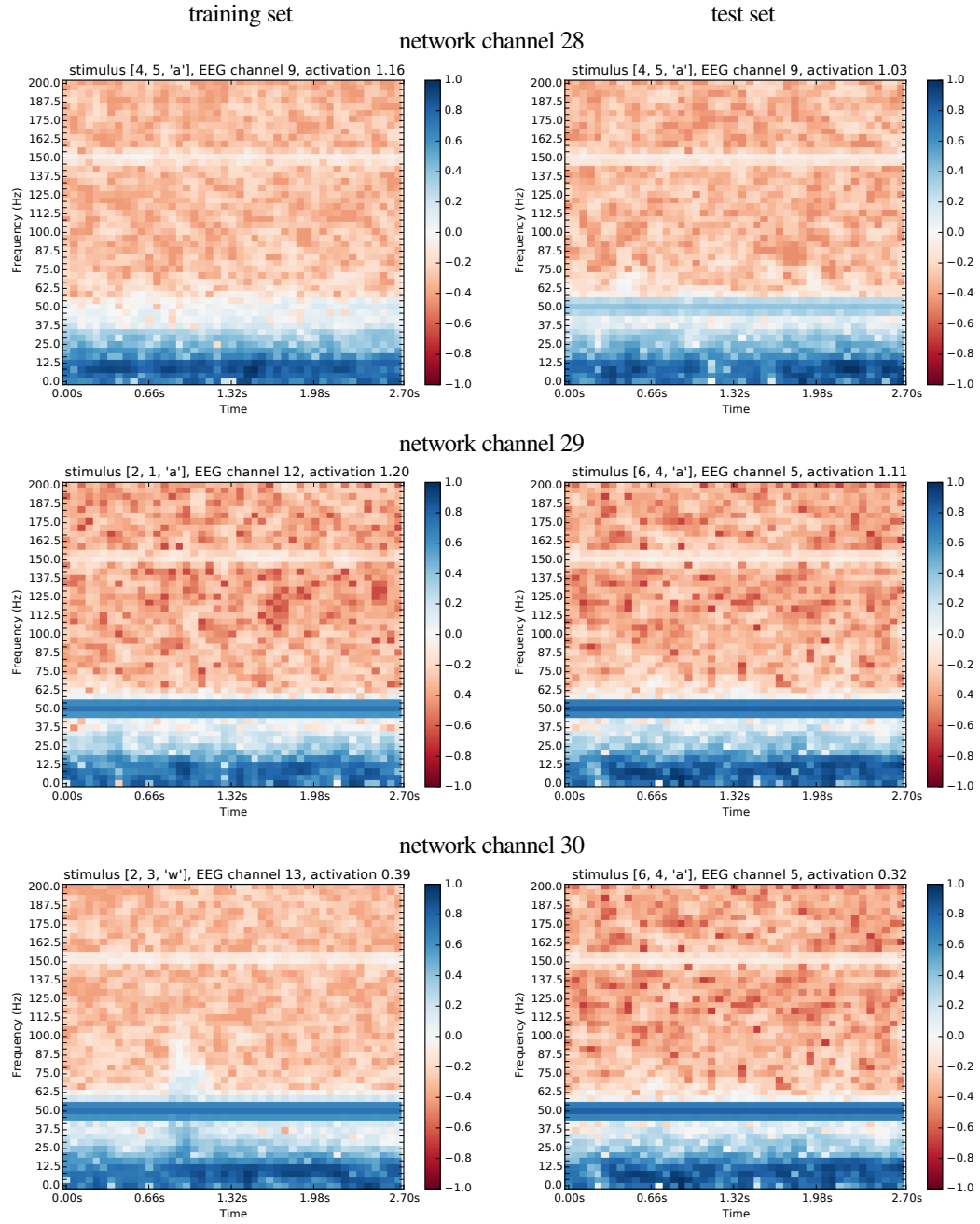


Figure 16: Inputs producing maximum activations for channels 28–30 in the CNN with a single convolutional layer for subject 4.

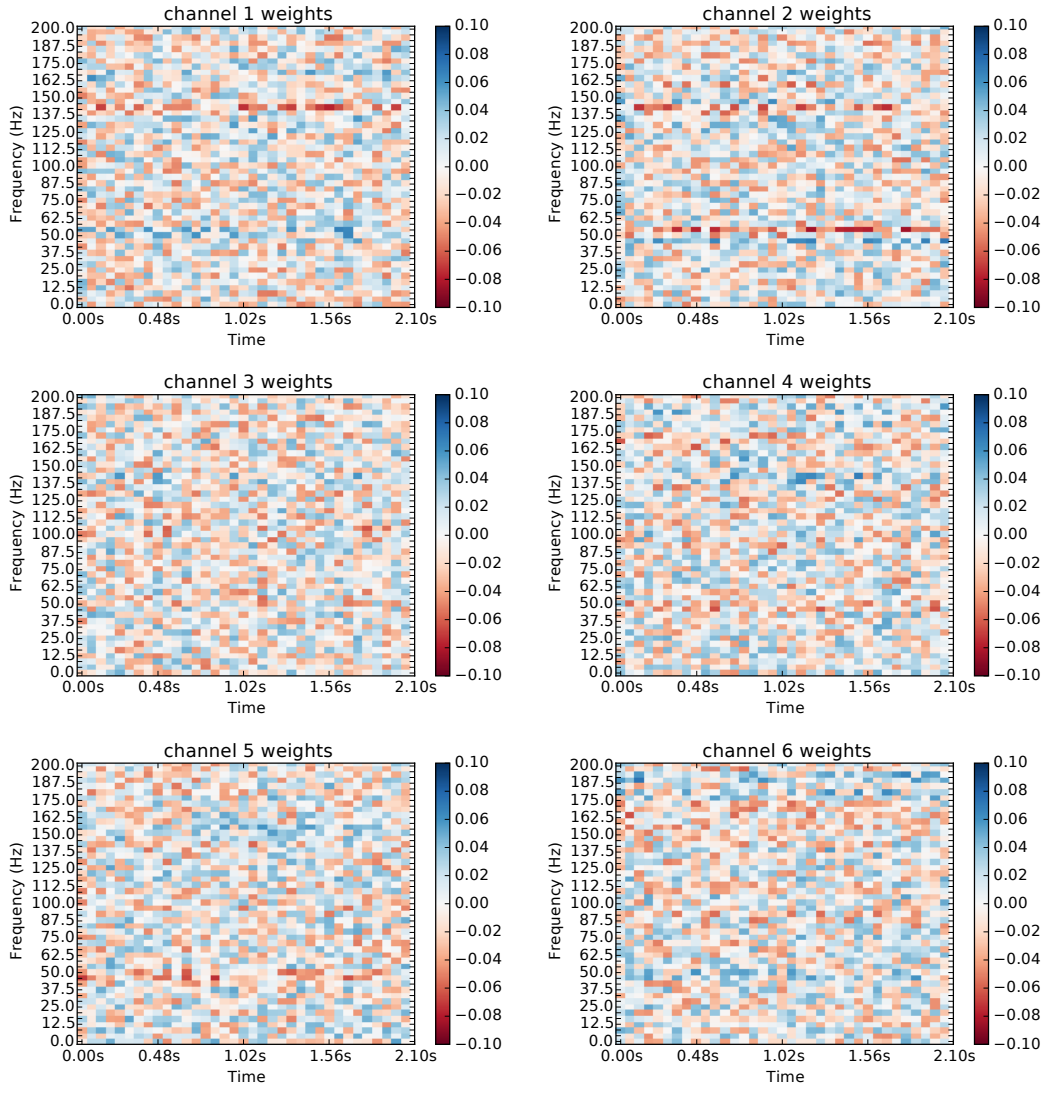


Figure 17: Weight matrices visualized as frequency spectrum for channels 1–6 in the CNN with a single convolutional layer for subject 4.

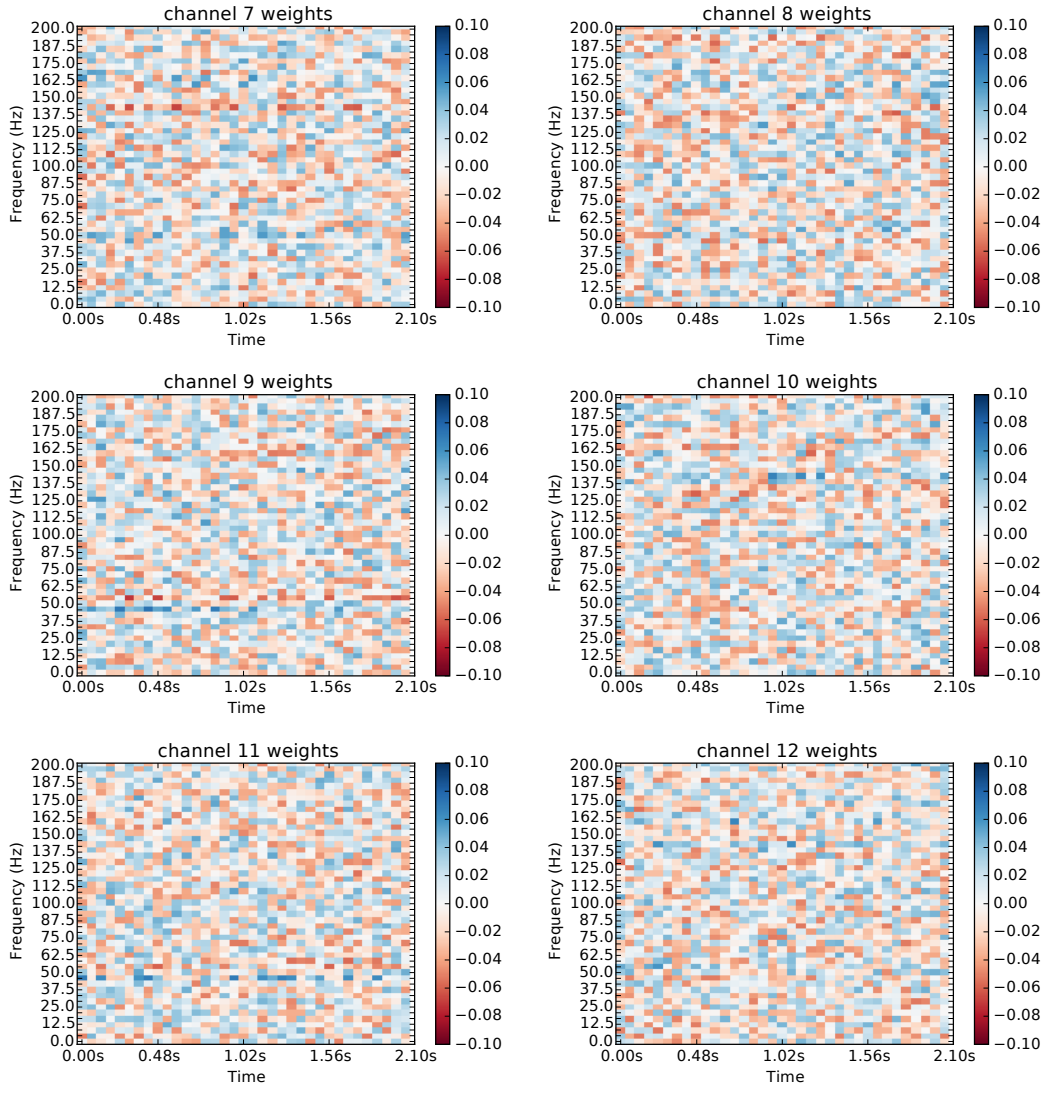


Figure 18: Weight matrices visualized as frequency spectrum for channels 7–12 in the CNN with a single convolutional layer for subject 4.

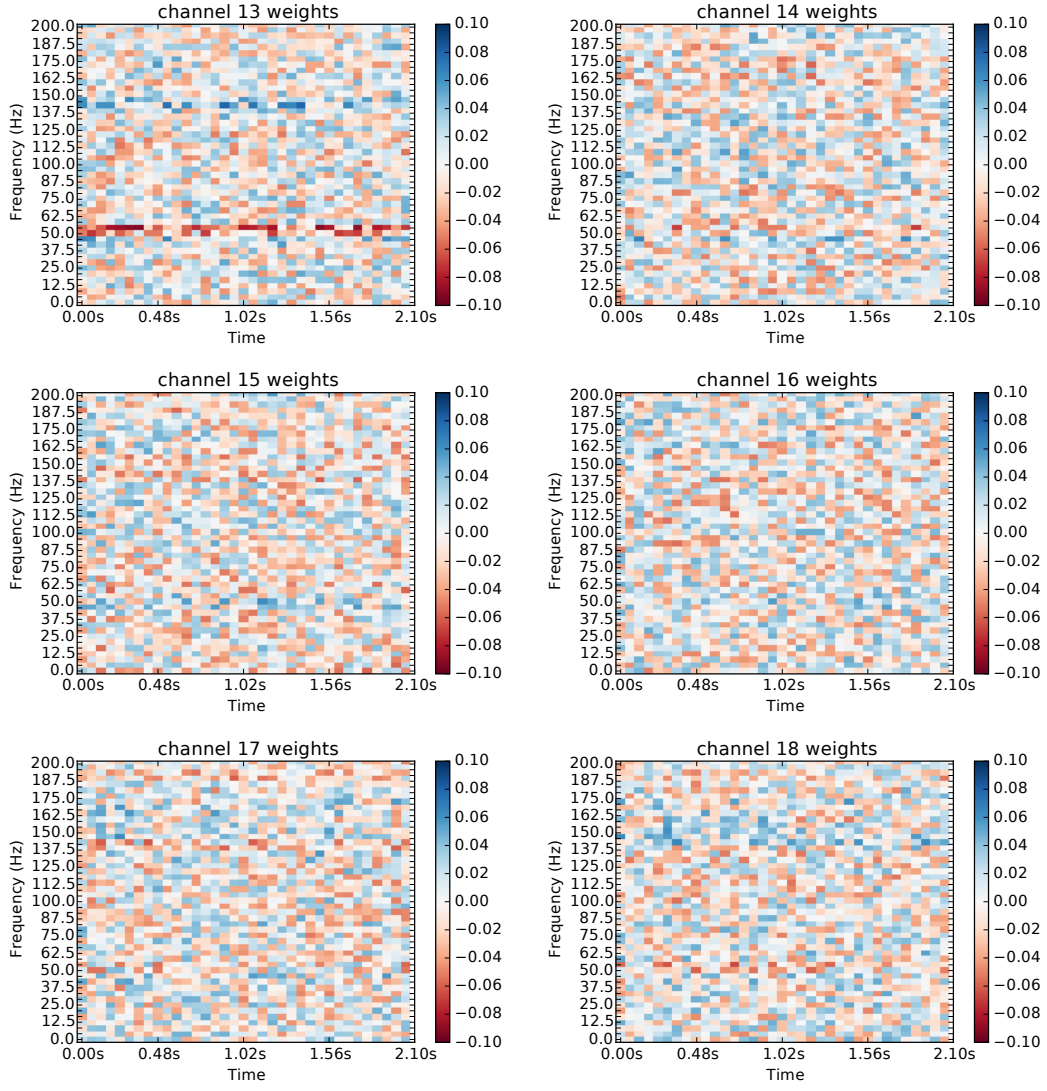


Figure 19: Weight matrices visualized as frequency spectrum for channels 13–18 in the CNN with a single convolutional layer for subject 4.

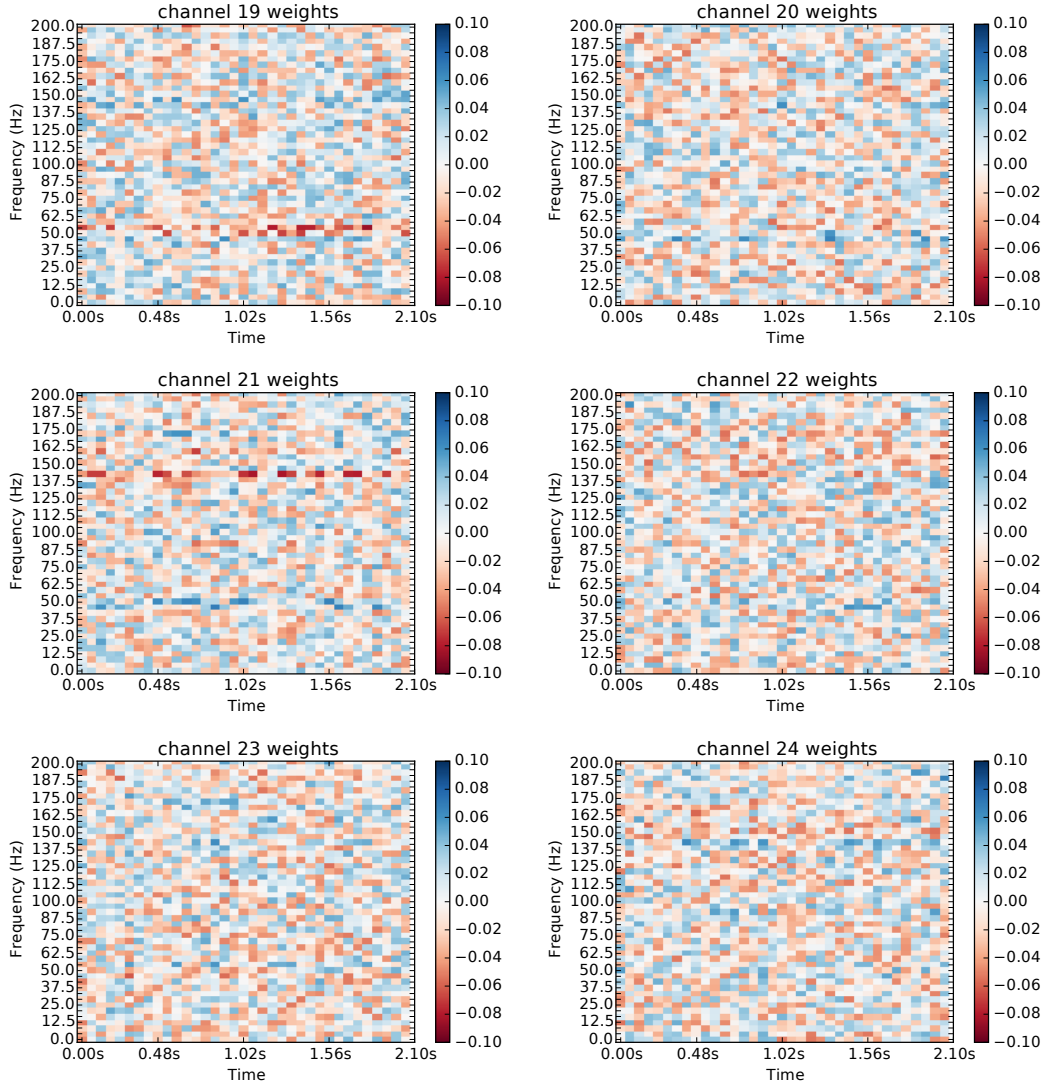


Figure 20: Weight matrices visualized as frequency spectrum for channels 19–24 in the CNN with a single convolutional layer for subject 4.

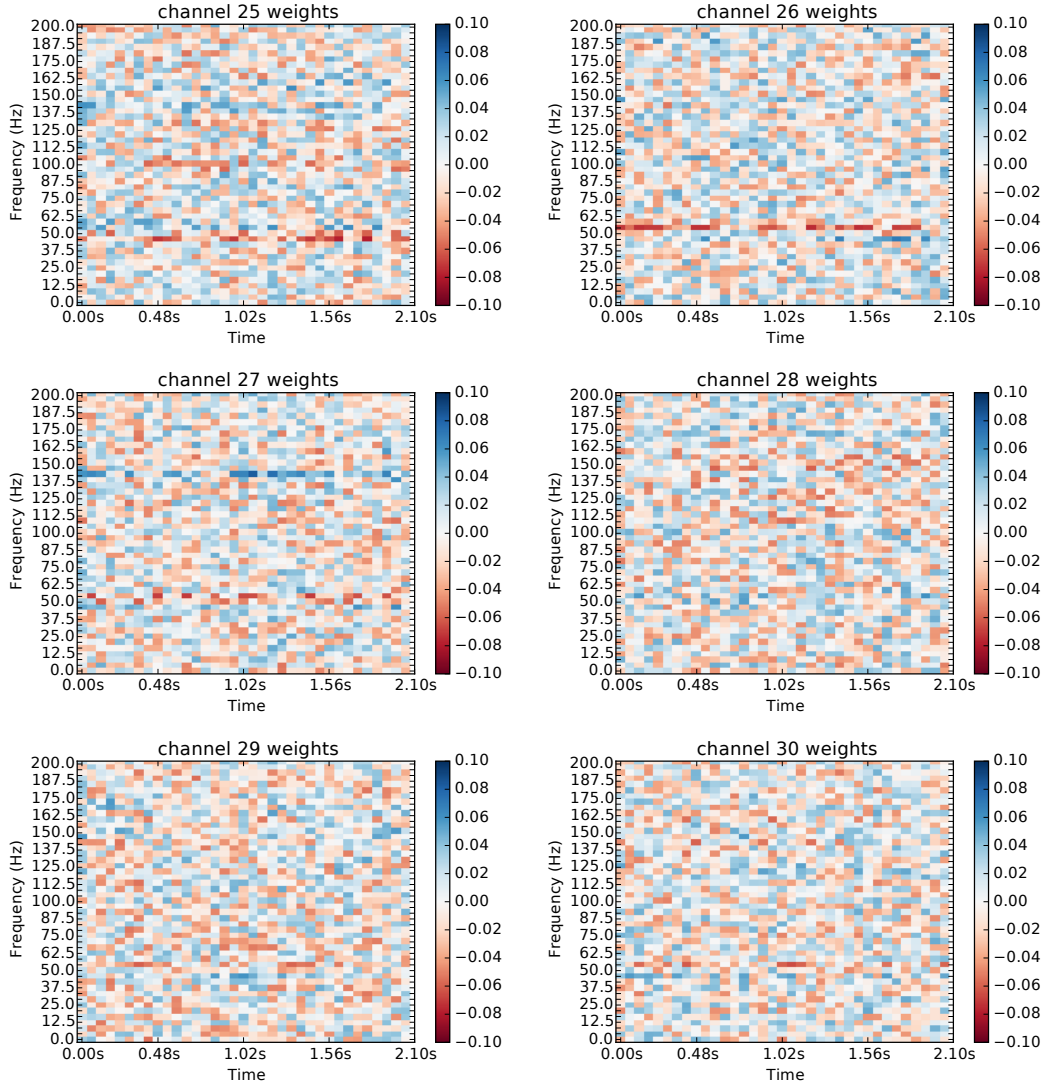


Figure 21: Weight matrices visualized as frequency spectrum for channels 25–30 in the CNN with a single convolutional layer for subject 4.