Supplementary Materials: Hyperspectral-based Classification of Managed Permanent Grassland With Multilayer Perceptrons: Influence of Spectral Band Count and Spectral Regions on Model Performance

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Table S1. Mean classification accuracy (MCA) and weighted F1 score (F1) values based on the different variants in different approaches. Approaches: reference variants (Ref.), ANOVA approach (ANOVA), peak approach (Peak), and reduction approach (Red.). Variants with the postfix "-O" were processed without Savitzky–Golay filtering and derivation. Statistical significance was calculated for MCA and F1 in a joint analysis ($\alpha = 5\,\%$). Significance letters are given in alphabetical ranges. Upper case letters follow lower case letters. All letters enclosed in the ranges belong to the same significance group. Different letters denote significant differences. Values with standard deviation, 5-fold cross-validated.

Approach	Variant	Input size	MCA [%]	Stat. sig. MCA	F1 [%]	Stat. sig. F1
Ref.	Baseline	191	86.1 ± 0.4	a	86.1 ± 0.4	a
Ref.	Baseline-O	192	81.8 ± 1.3	g - k	82.0 ± 1.2	f - j
Ref.	Even bands	96	82.2 ± 0.4	e - i	82.2 ± 0.4	e - i
Ref.	Odd bands	95	81.5 ± 0.3	g - l	81.5 ± 0.3	g - l
Ref.	DCS	9	62.8 ± 2.8	D - E	64.3 ± 2.2	B - D
Ref.	DCS-O	10	76.2 ± 1.3	q - u	77.0 ± 1.1	p - s
Ref.	Sentinel	9	64.9 ± 0.7	B - C	66.1 ± 0.6	B
Ref.	Sentinel-O	10	69.6 ± 1.2	z - A	70.6 ± 0.8	z - A
ANOVA	D $\geq$ 33 / 36	144	84.6 ± 0.1	a - d	84.7 ± 0.2	a - c
ANOVA	D $\geq$ 34 / 36	119	84.0 ± 0.6	b - f	84.1 ± 0.5	b - e
ANOVA	D $\geq$ 35 / 36	87	82.5 ± 0.5	e - h	82.6 ± 0.5	d - g
ANOVA	D = 36 / 36	34	74.9 ± 0.2	t - x	75.0 ± 0.2	s - x
ANOVA	D = 36 / 36, C $\leq$ 95	31	73.9 ± 0.3	v - x	74.3 ± 0.2	u - x
ANOVA	D = 36 / 36, C $\leq$ 85	29	69.3 ± 0.7	z - A	70.1 ± 0.6	z - A
ANOVA	D = 36 / 36, C $\leq$ 75	21	62.7 ± 0.6	D - E	63.6 ± 0.6	C - D
ANOVA	D = 36 / 36, C $\leq$ 65	17	60.1 ± 0.5	F - G	61.2 ± 0.4	E - F
ANOVA	D = 36 / 36, C $\leq$ 55	12	54.1 ± 1.0	I	55.1 ± 1.0	I
ANOVA	D = 36 / 36, C $\leq$ 45	10	50.0 ± 1.3	J	50.0 ± 0.9	J
Peak	Top 30 per class	103	80.3 ± 0.5	i - m	80.5 ± 0.4	h - m
Peak	Top 25 per class	95	80.1 ± 0.3	j - m	80.2 ± 0.3	i - m
Peak	Top 20 per class	83	79.4 ± 0.5	m - o	79.5 ± 0.4	l - o
Peak	Top 15 per class	63	78.6 ± 0.6	m - p	78.5 ± 0.5	m - p
Peak	Top 10 per class	42	76.4 ± 0.3	q - t	76.7 ± 0.2	p - t
Peak	Top 7 per class	30	73.5 ± 0.5	w - x	73.6 ± 0.4	w - x
Peak	Top 5 per class	22	70.4 ± 0.5	z - A	71.2 ± 0.5	y - z
Peak	Top 3 per class	14	62.4 ± 0.8	D - E	63.9 ± 0.5	C - D
Peak	Ignoring classes	22	57.9 ± 0.7	H	58.9 ± 0.5	G - H
Red.	R1	152	85.2 ± 0.6	a - b	85.3 ± 0.6	a - b
Red.	R2	121	84.8 ± 0.5	a - c	84.8 ± 0.6	a - c
Red.	R3	96	83.9 ± 0.7	b - f	84.0 ± 0.6	b - f
Red.	R4	76	83.2 ± 0.7	c - g	83.2 ± 0.5	c - g
Red.	R5	60	81.4 ± 0.7	g - l	81.6 ± 0.7	g - k
Red.	R6	48	79.9 ± 0.6	k - n	80.1 ± 0.5	j - m
Red.	R7	38	77.8 ± 0.6	o - r	78.0 ± 0.4	n - q
Red.	R8	30	75.4 ± 0.7	s - w	75.9 ± 0.5	r - v
Red.	R9	24	73.1 ± 1.0	x - y	73.6 ± 1.0	w - x
Red.	R10	19	68.7 ± 0.8	A	69.3 ± 0.6	z - A
Red.	R11	15	64.4 ± 0.5	B - D	65.3 ± 0.4	B - C
Red.	R12	12	58.9 ± 0.9	G - H	60.0 ± 0.8	F - G
Red.	R13	9	54.8 ± 0.3	I	55.4 ± 0.6	I

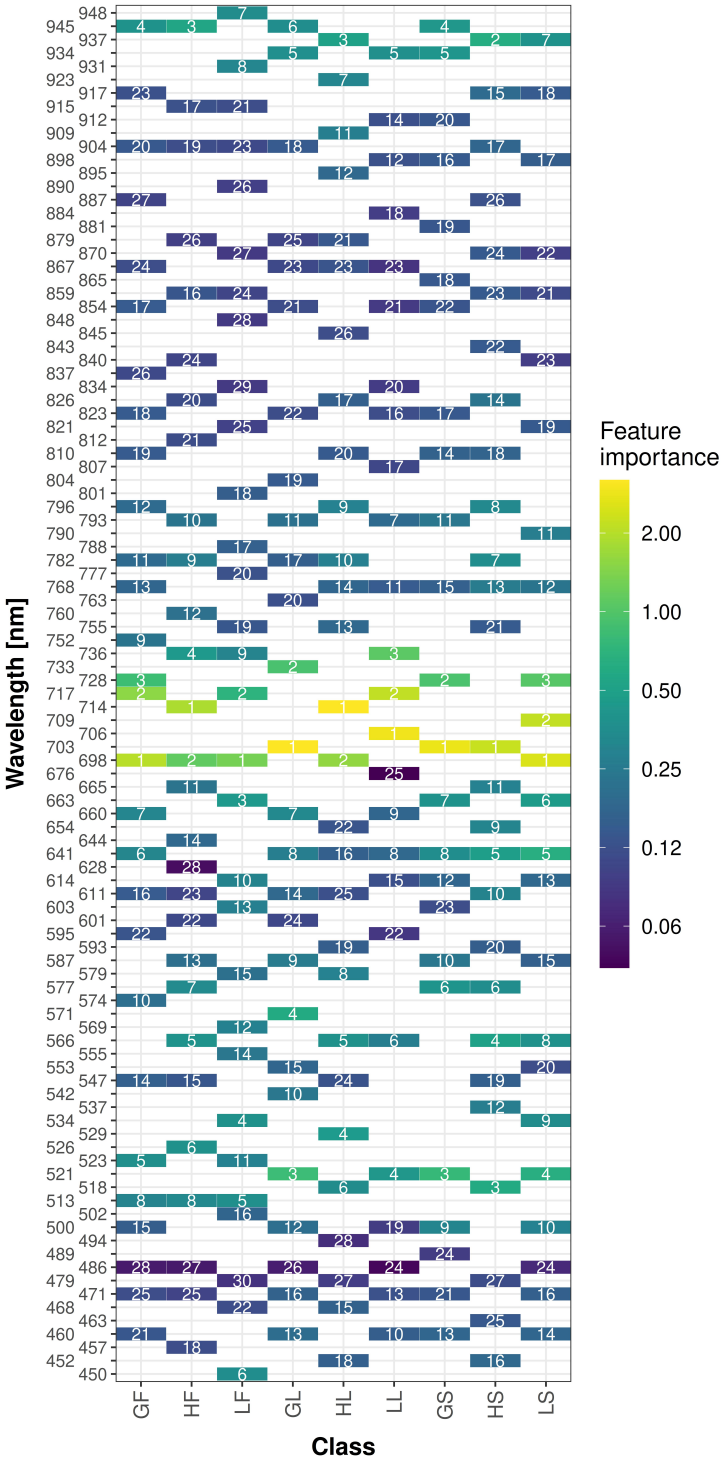

Figure S1. Feature importance of peaks selected via the peak approach based on different classes. First character: G = grass, H = herb, L = legume. Second character: F = flower, L = leaf, S = stem. Numbers in the tiles denote the peak height ranking for each class (lowest number = highest peak).

Table S2. Classification accuracy for flowers, leaves, and stems based on different species groups, variants, and approaches. Approaches: reference variants (Ref.), ANOVA approach (ANOVA), peak approach (Peak), and reduction approach (Red.). Variants with the postfix "-O" were processed without Savitzky–Golay filtering and derivation. Statistical significance was calculated individually for flowers, leaves, and stems ($\alpha = 5\,\%$). Significance letters are given in alphabetical ranges. Upper case letters follow lower case letters. All letters enclosed in the ranges belong to the same significance group. Different letters denote significant differences. Values with standard deviation, 5-fold cross-validated.

				Flower		Leaf		Stem	
Approach	Variant	Input size	Species group	Accuracy [%]	Stat. sig.	Accuracy [%]	Stat. sig.	Accuracy [%]	Stat. sig.
Ref.	Baseline	191	Grass	86.2 ± 4.5	a - r	88.9 ± 2.1	a - f	72.5 ± 4.9	b - q
Ref.	Baseline	191	Herb	84.6 ± 1.5	a - u	89.0 ± 1.6	a - e	60.3 ± 6.6	m - E
Ref.	Baseline	191	Legume	93.7 ± 1.9	a - c	91.0 ± 2.3	a - b	88.9 ± 3.5	a
Ref.	Baseline-O	192	Grass	87.3 ± 5.1	a - o	83.9 ± 4.3	a - p	65.6 ± 4.5	j - y
Ref.	Baseline-O	192	Herb	82.9 ± 2.8	d - w	88.8 ± 3.7	a - f	60.0 ± 11.3	m - F
Ref.	Baseline-O	192	Legume	92.5 ± 2.9	a - f	87.9 ± 2.9	a - g	78.5 ± 3.3	a - l
Ref.	Even bands	96	Grass	83.6 ± 2.6	c - v	84.9 ± 3.1	a - o	65.2 ± 5.5	k - y
Ref.	Even bands	96	Herb	76.8 ± 2.1	q - E	84.2 ± 3.7	a - p	56.6 ± 7.2	r - J
Ref.	Even bands	96	Legume	92.9 ± 1.3	a - d	89.2 ± 2.2	a - e	84.3 ± 3.4	a - f
Ref.	Odd bands	95	Grass	83.8 ± 2.2	b - v	83.8 ± 1.9	a - p	66.2 ± 5.5	j - y
Ref.	Odd bands	95	Herb	74.5 ± 4.0	u - H	77.4 ± 5.0	i - z	54.2 ± 5.1	v - L
Ref.	Odd bands	95	Legume	92.6 ± 1.8	a - e	89.2 ± 1.0	a - e	82.5 ± 1.9	a - h
Ref.	DCS	9	Grass	64.5 ± 8.0	H - P	60.7 ± 8.3	G - M	49.4 ± 8.1	z - O
Ref.	DCS	9	Herb	71.0 ± 4.7	A - J	80.6 ± 6.0	d - u	46.3 ± 5.4	C - P
Ref.	DCS	9	Legume	83.9 ± 3.0	b - v	76.6 ± 2.9	l - B	54.8 ± 9.3	v - L
Ref.	DCS-O	10	Grass	79.3 ± 3.1	m - C	77.9 ± 4.2	h - z	65.6 ± 2.7	j - y
Ref.	DCS-O	10	Herb	77.6 ± 2.4	o - E	85.3 ± 4.9	a - n	52.1 ± 8.6	x - O
Ref.	DCS-O	10	Legume	88.3 ± 2.9	a - n	81.5 ± 2.4	b - t	69.6 ± 3.2	d - v
Ref.	Sentinel	9	Grass	66.3 ± 4.0	F - O	65.2 ± 2.1	D - K	56.5 ± 5.0	r - J
Ref.	Sentinel	9	Herb	72.1 ± 4.8	y - I	80.3 ± 7.7	d - u	48.0 ± 14.3	B - O
Ref.	Sentinel	9	Legume	75.6 ± 4.3	t - G	75.2 ± 4.1	o - C	54.1 ± 5.0	v - M
Ref.	Sentinel-O	10	Grass	71.3 ± 3.0	z - J	68.6 ± 4.1	y - I	59.0 ± 3.8	o - G
Ref.	Sentinel-O	10	Herb	77.0 ± 4.3	p - E	84.3 ± 3.0	a - p	46.1 ± 9.1	D - P
Ref.	Sentinel-O	10	Legume	81.1 ± 3.5	h - A	79.7 ± 2.6	e - v	65.4 ± 4.7	k - y
ANOVA	D $\geq$ 33 / 36	144	Grass	85.9 ± 2.1	a - s	86.1 ± 1.7	a - l	72.1 ± 4.7	b - r
ANOVA	D $\geq$ 33 / 36	144	Herb	82.6 ± 3.5	e - x	89.2 ± 1.7	a - e	58.8 ± 8.0	o - G
ANOVA	D $\geq$ 33 / 36	144	Legume	93.9 ± 2.7	a - b	89.9 ± 1.0	a - d	86.1 ± 1.3	a - c
ANOVA	D $\geq$ 34 / 36	119	Grass	84.6 ± 1.9	a - u	85.4 ± 2.2	a - m	71.8 ± 2.1	b - r
ANOVA	D $\geq$ 34 / 36	119	Herb	79.4 ± 2.3	l - C	86.1 ± 2.6	a - l	58.7 ± 5.4	o - G
ANOVA	D $\geq$ 34 / 36	119	Legume	93.6 ± 2.1	a - c	89.5 ± 0.5	a - d	86.2 ± 2.1	a - c
ANOVA	D $\geq$ 35 / 36	87	Grass	86.3 ± 2.8	a - r	84.7 ± 2.4	a - o	65.1 ± 5.2	k - z
ANOVA	D $\geq$ 35 / 36	87	Herb	79.8 ± 4.3	k - B	86.0 ± 4.5	a - l	56.6 ± 6.3	r - J
ANOVA	D $\geq$ 35 / 36	87	Legume	93.5 ± 1.5	a - c	87.5 ± 1.9	a - h	84.7 ± 2.3	a - e
ANOVA	D = 36 / 36	34	Grass	80.0 ± 2.6	j - B	77.8 ± 3.9	h - z	56.4 ± 4.2	r - J
ANOVA	D = 36 / 36	34	Herb	58.8 ± 4.5	M - S	72.3 ± 3.4	s - E	44.4 ± 4.4	F - P
ANOVA	D = 36 / 36	34	Legume	88.6 ± 2.5	a - n	81.6 ± 2.0	a - t	74.9 ± 3.9	a - n
ANOVA	D = 36 / 36, C $\leq$ 95	31	Grass	76.2 ± 2.8	r - F	77.6 ± 2.3	i - z	58.2 ± 4.9	o - H
ANOVA	D = 36 / 36, C $\leq$ 95	31	Herb	60.4 ± 4.4	K - S	77.7 ± 1.4	h - z	46.2 ± 5.7	C - P
ANOVA	D = 36 / 36, C $\leq$ 95	31	Legume	88.4 ± 1.3	a - n	79.1 ± 2.2	f - w	70.8 ± 2.0	c - t
ANOVA	D = 36 / 36, C $\leq$ 85	29	Grass	72.7 ± 2.8	x - I	67.1 ± 1.7	B - J	57.0 ± 2.1	p - J
ANOVA	D = 36 / 36, C $\leq$ 85	29	Herb	58.7 ± 6.3	M - S	69.8 ± 4.9	w - G	48.9 ± 9.6	A - O
ANOVA	D = 36 / 36, C $\leq$ 85	29	Legume	87.0 ± 1.4	a - p	78.3 ± 1.7	g - y	71.2 ± 3.5	b - s
ANOVA	D = 36 / 36, C $\leq$ 75	21	Grass	68.2 ± 5.3	E - N	58.3 ± 4.2	J - M	51.8 ± 6.2	x - O
ANOVA	D = 36 / 36, C $\leq$ 75	21	Herb	50.4 ± 4.6	S - V	64.7 ± 4.6	E - L	39.2 ± 7.5	L - P
ANOVA	D = 36 / 36, C $\leq$ 75	21	Legume	82.9 ± 3.1	d - x	73.1 ± 2.0	r - E	63.9 ± 3.0	l - A
ANOVA	D = 36 / 36, C $\leq$ 65	17	Grass	65.9 ± 2.8	G - P	55.1 ± 2.1	L - N	51.5 ± 5.0	x - O
ANOVA	D = 36 / 36, C $\leq$ 65	17	Herb	44.5 ± 6.1	V - W	61.7 ± 6.2	F - M	45.6 ± 8.8	D - P
ANOVA	D = 36 / 36, C $\leq$ 65	17	Legume	79.2 ± 2.0	m - C	70.0 ± 2.1	v - G	59.7 ± 3.2	m - F
ANOVA	D = 36 / 36, C $\leq$ 55	12	Grass	57.9 ± 1.6	O - T	48.3 ± 3.6	N	43.8 ± 3.2	G - P
ANOVA	D = 36 / 36, C $\leq$ 55	12	Herb	36.0 ± 5.4	W	54.5 ± 3.1	M - N	39.8 ± 6.8	K - P
ANOVA	D = 36 / 36, C $\leq$ 55	12	Legume	74.2 ± 2.7	v - H	65.6 ± 4.7	C - K	58.9 ± 2.6	o - G
ANOVA	D = 36 / 36, C $\leq$ 45	10	Grass	52.1 ± 3.0	R - V	52.7 ± 4.9	M - N	31.9 ± 2.4	P - Q
ANOVA	D = 36 / 36, C $\leq$ 45	10	Herb	15.7 ± 4.9	X	34.2 ± 5.4	O	20.8 ± 4.1	Q

ANOVA	D = 36 / 36, C $\leq$ 45	10	Legume	73.9 ± 4.7	v - H	56.2 ± 3.7	K - N	52.2 ± 4.4	x - O
Peak	Top 30 per class	103	Grass	81.3 ± 2.9	h - z	82.6 ± 2.7	a - r	66.6 ± 3.7	i - y
Peak	Top 30 per class	103	Herb	75.8 ± 2.7	s - G	82.9 ± 3.1	a - r	55.1 ± 7.8	t - K
Peak	Top 30 per class	103	Legume	90.9 ± 2.5	a - h	85.9 ± 2.2	a - l	81.1 ± 1.5	a - j
Peak	Top 25 per class	95	Grass	80.9 ± 1.4	h - A	82.1 ± 1.7	a - s	65.6 ± 3.7	j - y
Peak	Top 25 per class	95	Herb	73.1 ± 4.2	w - H	81.1 ± 4.4	c - t	53.1 ± 11.7	x - N
Peak	Top 25 per class	95	Legume	92.0 ± 2.3	a - g	86.3 ± 1.3	a - l	82.7 ± 3.8	a - g
Peak	Top 20 per class	83	Grass	80.5 ± 2.1	i - A	80.7 ± 3.8	c - u	65.5 ± 4.3	j - y
Peak	Top 20 per class	83	Herb	73.9 ± 3.4	v - H	80.5 ± 4.5	d - u	49.0 ± 2.4	A - O
Peak	Top 20 per class	83	Legume	90.0 ± 2.2	a - j	86.7 ± 1.4	a - k	82.3 ± 2.9	a - i
Peak	Top 15 per class	63	Grass	80.3 ± 3.2	j - A	82.7 ± 3.7	a - r	59.2 ± 6.4	n - G
Peak	Top 15 per class	63	Herb	71.7 ± 1.1	z - J	76.7 ± 5.5	l - B	48.7 ± 4.8	A - O
Peak	Top 15 per class	63	Legume	89.9 ± 2.5	a - k	86.4 ± 2.8	a - l	79.2 ± 3.5	a - l
Peak	Top 10 per class	42	Grass	78.9 ± 2.8	n - D	78.9 ± 2.5	g - x	61.1 ± 3.5	m - D
Peak	Top 10 per class	42	Herb	65.9 ± 3.8	G - P	75.7 ± 6.3	m - B	47.0 ± 6.6	B - P
Peak	Top 10 per class	42	Legume	89.2 ± 1.1	a - m	84.1 ± 3.0	a - p	75.2 ± 4.8	a - m
Peak	Top 7 per class	30	Grass	75.1 ± 3.4	u - G	76.9 ± 1.7	l - B	55.6 ± 4.4	s - J
Peak	Top 7 per class	30	Herb	58.7 ± 5.8	M - S	71.0 ± 4.8	u - F	41.6 ± 7.0	J - P
Peak	Top 7 per class	30	Legume	86.6 ± 2.1	a - q	82.7 ± 1.4	a - r	73.1 ± 4.1	a - o
Peak	Top 5 per class	22	Grass	73.7 ± 4.3	v - H	71.9 ± 1.5	t - E	55.6 ± 2.9	s - J
Peak	Top 5 per class	22	Herb	59.8 ± 7.4	L - S	77.0 ± 2.2	k - A	45.9 ± 6.3	D - P
Peak	Top 5 per class	22	Legume	82.9 ± 2.3	d - w	77.7 ± 1.7	h - z	68.9 ± 5.4	f - w
Peak	Top 3 per class	14	Grass	65.9 ± 4.8	G - P	65.5 ± 2.6	C - K	48.8 ± 4.4	A - O
Peak	Top 3 per class	14	Herb	52.9 ± 4.9	Q - V	78.0 ± 5.5	h - z	42.4 ± 9.1	H - P
Peak	Top 3 per class	14	Legume	71.2 ± 2.9	z - J	69.9 ± 5.1	v - G	53.6 ± 4.5	w - N
Peak	Ignoring classes	22	Grass	56.0 ± 2.4	P - U	59.2 ± 2.3	I - M	47.0 ± 4.7	B - P
Peak	Ignoring classes	22	Herb	45.1 ± 8.0	V - W	67.4 ± 4.6	A - J	42.1 ± 6.6	I - P
Peak	Ignoring classes	22	Legume	79.1 ± 1.9	m - C	67.3 ± 2.8	A - J	49.1 ± 4.7	A - O
Red.	R1	152	Grass	86.2 ± 2.0	a - r	86.9 ± 1.5	a - j	73.2 ± 3.7	a - o
Red.	R1	152	Herb	85.6 ± 2.4	a - t	85.0 ± 3.0	a - n	62.0 ± 5.5	m - C
Red.	R1	152	Legume	93.6 ± 2.5	a - c	91.3 ± 1.5	a	86.3 ± 1.3	a - c
Red.	R2	121	Grass	86.5 ± 2.7	a - q	87.1 ± 1.4	a - i	69.2 ± 6.2	e - w
Red.	R2	121	Herb	82.0 ± 4.7	g - y	86.0 ± 2.1	a - l	62.5 ± 6.8	m - B
Red.	R2	121	Legume	94.3 ± 1.2	a	91.2 ± 1.3	a - b	86.7 ± 2.5	a - b
Red.	R3	96	Grass	84.4 ± 4.2	a - u	85.0 ± 1.9	a - n	72.6 ± 3.2	b - p
Red.	R3	96	Herb	84.6 ± 2.1	a - u	85.0 ± 2.3	a - o	56.5 ± 7.9	r - J
Red.	R3	96	Legume	93.9 ± 0.5	a - b	90.5 ± 2.2	a - c	84.9 ± 2.5	a - e
Red.	R4	76	Grass	84.5 ± 2.0	a - u	85.8 ± 3.6	a - l	67.1 ± 5.6	g - x
Red.	R4	76	Herb	81.3 ± 3.6	h - z	83.5 ± 2.9	a - p	57.8 ± 3.8	o - I
Red.	R4	76	Legume	92.4 ± 1.6	a - f	90.0 ± 1.6	a - d	85.2 ± 1.2	a - d
Red.	R5	60	Grass	82.0 ± 2.8	g - y	83.4 ± 2.3	a - p	67.0 ± 2.1	h - x
Red.	R5	60	Herb	79.2 ± 2.9	m - C	82.9 ± 3.8	a - r	54.0 ± 4.9	v - M
Red.	R5	60	Legume	92.1 ± 2.7	a - g	88.0 ± 1.1	a - g	84.1 ± 2.5	a - f
Red.	R6	48	Grass	82.3 ± 1.7	f - x	81.8 ± 3.4	a - s	64.4 ± 4.5	l - A
Red.	R6	48	Herb	78.0 ± 3.3	o - E	82.3 ± 1.8	a - r	56.7 ± 7.6	q - J
Red.	R6	48	Legume	90.6 ± 1.7	a - i	86.1 ± 2.9	a - l	80.8 ± 4.0	a - k
Red.	R7	38	Grass	78.7 ± 3.5	n - D	81.7 ± 1.8	a - t	58.7 ± 3.1	o - G
Red.	R7	38	Herb	74.9 ± 3.3	u - G	83.9 ± 2.1	a - p	53.9 ± 9.6	v - N
Red.	R7	38	Legume	89.5 ± 2.2	a - l	83.1 ± 2.3	a - q	79.2 ± 5.5	a - l
Red.	R8	30	Grass	76.2 ± 1.0	r - F	79.1 ± 2.3	f - w	58.5 ± 3.7	o - G
Red.	R8	30	Herb	69.5 ± 2.2	C - L	80.8 ± 3.7	c - u	55.0 ± 6.8	u - K
Red.	R8	30	Legume	87.4 ± 1.5	a - o	82.2 ± 1.8	a - r	73.4 ± 5.3	a - o
Red.	R9	24	Grass	75.5 ± 1.7	t - G	77.0 ± 1.9	k - A	54.2 ± 4.2	v - L
Red.	R9	24	Herb	68.8 ± 7.5	D - M	82.8 ± 1.6	a - r	52.7 ± 8.9	x - N
Red.	R9	24	Legume	83.3 ± 1.3	d - w	80.2 ± 1.0	d - u	70.6 ± 2.8	c - u
Red.	R10	19	Grass	70.1 ± 5.0	B - K	74.9 ± 1.9	p - D	49.1 ± 2.3	A - O
Red.	R10	19	Herb	58.5 ± 6.2	N - S	75.7 ± 3.3	m - B	57.1 ± 11.4	p - J
Red.	R10	19	Legume	79.4 ± 3.7	l - C	78.0 ± 3.2	h - z	58.7 ± 4.6	o - G
Red.	R11	15	Grass	62.8 ± 4.7	I - Q	68.5 ± 0.7	y - I	45.3 ± 3.2	E - P
Red.	R11	15	Herb	61.6 ± 7.2	J - R	77.2 ± 6.1	j - z	53.1 ± 5.9	x - N
Red.	R11	15	Legume	74.6 ± 3.9	u - H	75.5 ± 2.7	n - B	60.4 ± 3.2	m - E
Red.	R12	12	Grass	58.7 ± 2.2	N - S	65.7 ± 3.3	C - K	38.3 ± 4.0	N - P
Red.	R12	12	Herb	47.0 ± 7.2	U - V	68.3 ± 5.0	z - I	51.2 ± 11.1	y - O
Red.	R12	12	Legume	73.4 ± 4.0	w - H	69.1 ± 5.1	x - H	46.8 ± 5.4	B - P
Red.	R13	9	Grass	47.8 ± 5.5	T - V	59.7 ± 2.5	H - M	36.9 ± 4.5	O - P
Red.	R13	9	Herb	23.1 ± 3.7	X	57.1 ± 10.9	K - N	38.4 ± 10.2	M - P
Red.	R13	9	Legume	69.5 ± 4.9	C - L	73.4 ± 7.5	q - E	48.1 ± 4.1	B - O

Table S3. Final dataset as a function of seasonal cut, location, species group, and plant part. Locations: G = Raumberg–Gumpenstein, pure grass and legume stands; K1 = Pottenstein, intensively used grass-clover-mixture, rather wet soil; K2 = Pottenstein, intensively used grassland, relatively dry area; K3 = Pottenstein, extensively used meadow, relatively dry and hilly. Source: Supplements of Britz *et al.* [10] (modified).

Date	Seasonal Cut	Location	Species Group	Plant Part	Samples	Pixels
05.06.2019	1	G	Grass	Flower	52	5179
05.06.2019	1	G	Grass	Leaf	66	6579
05.06.2019	1	G	Grass	Stem	66	6575
05.06.2019	1	G	Legume	Flower	11	1095
05.06.2019	1	G	Legume	Leaf	32	3195
05.06.2019	1	G	Legume	Stem	36	3577
08.07.2019	2	K1	Grass	Flower	19	1898
08.07.2019	2	K1	Grass	Leaf	20	1996
08.07.2019	2	K1	Grass	Stem	2	199
08.07.2019	2	K1	Herb	Flower	20	1999
08.07.2019	2	K1	Herb	Leaf	22	2199
08.07.2019	2	K1	Herb	Stem	16	1587
08.07.2019	2	K1	Legume	Flower	26	2599
08.07.2019	2	K1	Legume	Leaf	35	3490
08.07.2019	2	K1	Legume	Stem	27	2670
08.07.2019	2	K2	Grass	Flower	44	4391
08.07.2019	2	K2	Grass	Leaf	10	996
08.07.2019	2	K2	Grass	Stem	31	3088
08.07.2019	2	K2	Herb	Flower	17	1697
08.07.2019	2	K2	Herb	Leaf	14	1397
08.07.2019	2	K2	Herb	Stem	14	1396
08.07.2019	2	K2	Legume	Flower	8	798
08.07.2019	2	K2	Legume	Leaf	10	999
08.07.2019	2	K2	Legume	Stem	20	1995
23.07.2019	2	G	Grass	Flower	84	8386
23.07.2019	2	G	Grass	Leaf	207	20632
23.07.2019	2	G	Grass	Stem	119	11855
23.07.2019	2	G	Legume	Flower	60	5986
23.07.2019	2	G	Legume	Leaf	58	5772
23.07.2019	2	G	Legume	Stem	65	6468
28.08.2019	3	K1	Grass	Leaf	25	2496
28.08.2019	3	K1	Grass	Stem	1	100
28.08.2019	3	K1	Herb	Leaf	32	3200
28.08.2019	3	K1	Herb	Stem	19	1892
28.08.2019	3	K1	Legume	Leaf	35	3491
28.08.2019	3	K1	Legume	Stem	36	3585
28.08.2019	3	K2	Grass	Flower	4	400
28.08.2019	3	K2	Grass	Leaf	27	2696
28.08.2019	3	K2	Grass	Stem	6	599
28.08.2019	3	K2	Herb	Leaf	28	2793
28.08.2019	3	K2	Herb	Stem	6	599
28.08.2019	3	K2	Legume	Leaf	9	899
28.08.2019	3	K2	Legume	Stem	9	896
29.08.2019	3	K3	Herb	Flower	20	1993
29.08.2019	3	K3	Herb	Leaf	55	5496
29.08.2019	3	K3	Herb	Stem	35	3492
29.08.2019	3	K3	Legume	Flower	16	1593
29.08.2019	3	K3	Legume	Leaf	28	2758
29.08.2019	3	K3	Legume	Stem	28	2789
12.09.2019	3	G	Grass	Flower	55	5478
12.09.2019	3	G	Grass	Leaf	212	21112
12.09.2019	3	G	Grass	Stem	35	3473
12.09.2019	3	G	Legume	Flower	37	3685
12.09.2019	3	G	Legume	Leaf	68	6775
12.09.2019	3	G	Legume	Stem	45	4453
03.-04.06.2020	1	G	Grass	Flower	399	39764
03.-04.06.2020	1	G	Grass	Leaf	441	44017
03.-04.06.2020	1	G	Grass	Stem	422	42087
03.-04.06.2020	1	G	Legume	Flower	55	5498
03.-04.06.2020	1	G	Legume	Leaf	118	11796

03.-04.06.2020	1	G	Legume	Stem	92	9186
29.07.2020	2	G	Grass	Leaf	239	23864
29.07.2020	2	G	Legume	Flower	52	5193
29.07.2020	2	G	Legume	Leaf	88	8798
29.07.2020	2	G	Legume	Stem	93	9285
21.-23.09.2020	3	G	Grass	Flower	169	16868
21.-23.09.2020	3	G	Grass	Leaf	726	72541
21.-23.09.2020	3	G	Grass	Stem	196	19596
21.-23.09.2020	3	G	Legume	Flower	133	13288
21.-23.09.2020	3	G	Legume	Leaf	247	24689
21.-23.09.2020	3	G	Legume	Stem	216	21574
					5768	575480

Table S4. Species definitely included in the dataset. For herbs, only the genus was determined. At VetFarm additional species might have been sampled. Source: Supplements of Britz *et al.* [10] (modified).

Species Group	Species
Grass	*Agrostis capillaris* L., *Agrostis gigantea* Roth, *Alopecurus pratensis* L., *Arrhenatherum elatius* (L.) P.Beauv. ex J.Presl & C.Presl, *Bromus erectus* Huds., *Cynosurus cristatus* L., *Dactylis glomerata* L., *Deschampsia cespitosa* (L.) P. Beauv., *Elymus repens (L.)* Gould, *Festuca ovina agg.* L., *Festuca pratensis* Huds., *Festuca rubra agg.* L., *Lolium hybridum* Hausskn., *Lolium multiflorum* Lam., *Lolium perenne* L., *Poa trivialis* L., *Poa pratensis* L., *Phleum pratense* L., *Trisetum flavescens* (L.) P.Beauv.
Herb	*Achillea* L., *Cirsium* Mill., *Leucanthemum* Mill., *Plantago* L., *Rumex* L., *Taraxacum* F.H. Wigg.
Legume	*Lotus corniculatus* L., *Medicago sativa* L., *Trifolium hybridum* L., *Trifolium pratense* L., *Trifolium repens* L.

Table S5. Hyperspectral camera (Specim Fx10) predictor info. ID = spectral band number, L = lower input predictor, H = higher input predictor, D = name of derived predictor. The unit of all predictor values is nm. L and H are presented with bandwidth defined by the full width at half maximum.

ID	L	H	D	ID	L	H	D	ID	L	H	D
1	440.43 ± 1.31	443.05 ± 1.31	442	65	610.09 ± 1.34	612.77 ± 1.34	611	129	783.51 ± 1.37	786.25 ± 1.37	785
2	443.05 ± 1.31	445.68 ± 1.31	444	66	612.77 ± 1.34	615.45 ± 1.34	614	130	786.25 ± 1.37	788.99 ± 1.37	788
3	445.68 ± 1.31	448.30 ± 1.31	447	67	615.45 ± 1.34	618.13 ± 1.34	617	131	788.99 ± 1.37	791.73 ± 1.37	790
4	448.30 ± 1.31	450.92 ± 1.31	450	68	618.13 ± 1.34	620.81 ± 1.34	619	132	791.73 ± 1.37	794.47 ± 1.37	793
5	450.92 ± 1.31	453.55 ± 1.31	452	69	620.81 ± 1.34	623.50 ± 1.34	622	133	794.47 ± 1.37	797.21 ± 1.37	796
6	453.55 ± 1.31	456.18 ± 1.31	455	70	623.50 ± 1.34	626.18 ± 1.34	625	134	797.21 ± 1.37	799.96 ± 1.37	799
7	456.18 ± 1.31	458.80 ± 1.31	457	71	626.18 ± 1.34	628.87 ± 1.34	628	135	799.96 ± 1.37	802.70 ± 1.38	801
8	458.80 ± 1.31	461.43 ± 1.31	460	72	628.87 ± 1.34	631.56 ± 1.34	630	136	802.70 ± 1.38	805.45 ± 1.38	804
9	461.43 ± 1.31	464.06 ± 1.31	463	73	631.56 ± 1.34	634.25 ± 1.34	633	137	805.45 ± 1.38	808.20 ± 1.38	807
10	464.06 ± 1.31	466.69 ± 1.31	465	74	634.25 ± 1.34	636.93 ± 1.34	636	138	808.20 ± 1.38	810.94 ± 1.38	810
11	466.69 ± 1.31	469.32 ± 1.31	468	75	636.93 ± 1.34	639.62 ± 1.34	638	139	810.94 ± 1.38	813.69 ± 1.38	812
12	469.32 ± 1.31	471.95 ± 1.31	471	76	639.62 ± 1.34	642.31 ± 1.34	641	140	813.69 ± 1.38	816.44 ± 1.38	815
13	471.95 ± 1.31	474.59 ± 1.31	473	77	642.31 ± 1.34	645.01 ± 1.34	644	141	816.44 ± 1.38	819.19 ± 1.38	818
14	474.59 ± 1.31	477.22 ± 1.31	476	78	645.01 ± 1.34	647.70 ± 1.34	646	142	819.19 ± 1.38	821.95 ± 1.38	821
15	477.22 ± 1.31	479.86 ± 1.31	479	79	647.70 ± 1.34	650.39 ± 1.34	649	143	821.95 ± 1.38	824.70 ± 1.38	823
16	479.86 ± 1.31	482.49 ± 1.32	481	80	650.39 ± 1.34	653.09 ± 1.34	652	144	824.70 ± 1.38	827.45 ± 1.38	826
17	482.49 ± 1.32	485.13 ± 1.32	484	81	653.09 ± 1.34	655.78 ± 1.35	654	145	827.45 ± 1.38	830.21 ± 1.38	829
18	485.13 ± 1.32	487.77 ± 1.32	486	82	655.78 ± 1.35	658.48 ± 1.35	657	146	830.21 ± 1.38	832.96 ± 1.38	832
19	487.77 ± 1.32	490.40 ± 1.32	489	83	658.48 ± 1.35	661.18 ± 1.35	660	147	832.96 ± 1.38	835.72 ± 1.38	834
20	490.40 ± 1.32	493.04 ± 1.32	492	84	661.18 ± 1.35	663.87 ± 1.35	663	148	835.72 ± 1.38	838.47 ± 1.38	837
21	493.04 ± 1.32	495.68 ± 1.32	494	85	663.87 ± 1.35	666.57 ± 1.35	665	149	838.47 ± 1.38	841.23 ± 1.38	840
22	495.68 ± 1.32	498.33 ± 1.32	497	86	666.57 ± 1.35	669.27 ± 1.35	668	150	841.23 ± 1.38	843.99 ± 1.38	843
23	498.33 ± 1.32	500.97 ± 1.32	500	87	669.27 ± 1.35	671.97 ± 1.35	671	151	843.99 ± 1.38	846.75 ± 1.38	845
24	500.97 ± 1.32	503.61 ± 1.32	502	88	671.97 ± 1.35	674.68 ± 1.35	673	152	846.75 ± 1.38	849.51 ± 1.38	848
25	503.61 ± 1.32	506.25 ± 1.32	505	89	674.68 ± 1.35	677.38 ± 1.35	676	153	849.51 ± 1.38	852.27 ± 1.38	851
26	506.25 ± 1.32	508.90 ± 1.32	508	90	677.38 ± 1.35	680.08 ± 1.35	679	154	852.27 ± 1.38	855.04 ± 1.38	854
27	508.90 ± 1.32	511.54 ± 1.32	510	91	680.08 ± 1.35	682.79 ± 1.35	681	155	855.04 ± 1.38	857.80 ± 1.38	856
28	511.54 ± 1.32	514.19 ± 1.32	513	92	682.79 ± 1.35	685.49 ± 1.35	684	156	857.80 ± 1.38	860.56 ± 1.38	859
29	514.19 ± 1.32	516.84 ± 1.32	516	93	685.49 ± 1.35	688.20 ± 1.35	687	157	860.56 ± 1.38	863.33 ± 1.39	862
30	516.84 ± 1.32	519.49 ± 1.32	518	94	688.20 ± 1.35	690.91 ± 1.35	690	158	863.33 ± 1.39	866.10 ± 1.39	865
31	519.49 ± 1.32	522.14 ± 1.32	521	95	690.91 ± 1.35	693.62 ± 1.35	692	159	866.10 ± 1.39	868.86 ± 1.39	867
32	522.14 ± 1.32	524.79 ± 1.32	523	96	693.62 ± 1.35	696.33 ± 1.35	695	160	868.86 ± 1.39	871.63 ± 1.39	870
33	524.79 ± 1.32	527.44 ± 1.32	526	97	696.33 ± 1.35	699.04 ± 1.35	698	161	871.63 ± 1.39	874.40 ± 1.39	873
34	527.44 ± 1.32	530.09 ± 1.32	529	98	699.04 ± 1.35	701.75 ± 1.35	700	162	874.40 ± 1.39	877.17 ± 1.39	876
35	530.09 ± 1.32	532.74 ± 1.32	531	99	701.75 ± 1.35	704.46 ± 1.35	703	163	877.17 ± 1.39	879.94 ± 1.39	879
36	532.74 ± 1.32	535.40 ± 1.32	534	100	704.46 ± 1.35	707.17 ± 1.35	706	164	879.94 ± 1.39	882.71 ± 1.39	881
37	535.40 ± 1.32	538.05 ± 1.32	537	101	707.17 ± 1.35	709.89 ± 1.35	709	165	882.71 ± 1.39	885.49 ± 1.39	884
38	538.05 ± 1.32	540.71 ± 1.33	539	102	709.89 ± 1.35	712.60 ± 1.35	711	166	885.49 ± 1.39	888.26 ± 1.39	887
39	540.71 ± 1.33	543.37 ± 1.33	542	103	712.60 ± 1.35	715.32 ± 1.36	714	167	888.26 ± 1.39	891.03 ± 1.39	890
40	543.37 ± 1.33	546.02 ± 1.33	545	104	715.32 ± 1.36	718.03 ± 1.36	717	168	891.03 ± 1.39	893.81 ± 1.39	892
41	546.02 ± 1.33	548.68 ± 1.33	547	105	718.03 ± 1.36	720.75 ± 1.36	719	169	893.81 ± 1.39	896.59 ± 1.39	895
42	548.68 ± 1.33	551.34 ± 1.33	550	106	720.75 ± 1.36	723.47 ± 1.36	722	170	896.59 ± 1.39	899.36 ± 1.39	898
43	551.34 ± 1.33	554.00 ± 1.33	553	107	723.47 ± 1.36	726.19 ± 1.36	725	171	899.36 ± 1.39	902.14 ± 1.39	901
44	554.00 ± 1.33	556.66 ± 1.33	555	108	726.19 ± 1.36	728.91 ± 1.36	728	172	902.14 ± 1.39	904.92 ± 1.39	904
45	556.66 ± 1.33	559.33 ± 1.33	558	109	728.91 ± 1.36	731.63 ± 1.36	730	173	904.92 ± 1.39	907.70 ± 1.39	906
46	559.33 ± 1.33	561.99 ± 1.33	561	110	731.63 ± 1.36	734.35 ± 1.36	733	174	907.70 ± 1.39	910.48 ± 1.39	909
47	561.99 ± 1.33	564.65 ± 1.33	563	111	734.35 ± 1.36	737.07 ± 1.36	736	175	910.48 ± 1.39	913.26 ± 1.39	912
48	564.65 ± 1.33	567.32 ± 1.33	566	112	737.07 ± 1.36	739.80 ± 1.36	738	176	913.26 ± 1.39	916.05 ± 1.39	915
49	567.32 ± 1.33	569.98 ± 1.33	569	113	739.80 ± 1.36	742.52 ± 1.36	741	177	916.05 ± 1.39	918.83 ± 1.39	917
50	569.98 ± 1.33	572.65 ± 1.33	571	114	742.52 ± 1.36	745.25 ± 1.36	744	178	918.83 ± 1.39	921.62 ± 1.39	920
51	572.65 ± 1.33	575.32 ± 1.33	574	115	745.25 ± 1.36	747.98 ± 1.36	747	179	921.62 ± 1.39	924.40 ± 1.40	923
52	575.32 ± 1.33	577.99 ± 1.33	577	116	747.98 ± 1.36	750.70 ± 1.36	749	180	924.40 ± 1.40	927.19 ± 1.40	926
53	577.99 ± 1.33	580.66 ± 1.33	579	117	750.70 ± 1.36	753.43 ± 1.36	752	181	927.19 ± 1.40	929.97 ± 1.40	929
54	580.66 ± 1.33	583.33 ± 1.33	582	118	753.43 ± 1.36	756.16 ± 1.36	755	182	929.97 ± 1.40	932.76 ± 1.40	931
55	583.33 ± 1.33	586.00 ± 1.33	585	119	756.16 ± 1.36	758.89 ± 1.36	758	183	932.76 ± 1.40	935.55 ± 1.40	934
56	586.00 ± 1.33	588.67 ± 1.33	587	120	758.89 ± 1.36	761.62 ± 1.36	760	184	935.55 ± 1.40	938.34 ± 1.40	937
57	588.67 ± 1.33	591.35 ± 1.33	590	121	761.62 ± 1.36	764.36 ± 1.36	763	185	938.34 ± 1.40	941.13 ± 1.40	940
58	591.35 ± 1.33	594.02 ± 1.33	593	122	764.36 ± 1.36	767.09 ± 1.36	766	186	941.13 ± 1.40	943.93 ± 1.40	943
59	594.02 ± 1.33	596.70 ± 1.34	595	123	767.09 ± 1.36	769.82 ± 1.36	768	187	943.93 ± 1.40	946.72 ± 1.40	945
60	596.70 ± 1.34	599.37 ± 1.34	598	124	769.82 ± 1.36	772.56 ± 1.37	771	188	946.72 ± 1.40	949.51 ± 1.40	948
61	599.37 ± 1.34	602.05 ± 1.34	601	125	772.56 ± 1.37	775.29 ± 1.37	774	189	949.51 ± 1.40	952.31 ± 1.40	951
62	602.05 ± 1.34	604.73 ± 1.34	603	126	775.29 ± 1.37	778.03 ± 1.37	777	190	952.31 ± 1.40	955.10 ± 1.40	954
63	604.73 ± 1.34	607.41 ± 1.34	606	127	778.03 ± 1.37	780.77 ± 1.37	779	191	955.10 ± 1.40	957.90 ± 1.40	956
64	607.41 ± 1.34	610.09 ± 1.34	609	128	780.77 ± 1.37	783.51 ± 1.37	782				

Table S6. Hyperparameter search space used to find hyperparameter combinations, delivering high multilayer perceptron model accuracy on the validation dataset. L1 and L2 = number of nodes in first and second hidden layer, respectively. LR = learning rate.

Parameter	Accepted Values
L1	10–100 with increments of 10, 100–1000 with increments of 50
L2	10–100 with increments of 10, 100–1000 with increments of 50
LR	1×10^{-1} to 1×10^{-4}
batch size	4, 8, 16, 32, 64, 128, 256, 512
weight decay	1×10^{-4}
momentum	0.9

Table S7. Hyperparameter combinations used for cross-validated multilayer perceptron training. IS = input size, BS = batch size, L1 and L2 = number of nodes in first and second hidden layer, respectively. LR = learning rate. Variants with the postfix "-O" were processed without Savitzky–Golay filtering and derivation.

Approach	Variant	IS	BS	LR	L1	L2
Ref.	Baseline	191	128	0.00668	900	600
Ref.	Baseline-O	192	16	0.00026	90	600
Ref.	Even bands	96	32	0.00115	800	900
Ref.	Odd bands	95	256	0.01654	950	400
Ref.	DCS	9	256	0.01444	50	450
Ref.	DCS-O	10	64	0.00027	800	400
Ref.	Sentinal	9	256	0.01444	50	450
Ref.	Sentinal-O	10	128	0.00074	1000	600
ANOVA	$D \geq 33$ / 36	144	16	0.00081	950	950
ANOVA	$D \geq 34$ / 36	119	32	0.00183	250	950
ANOVA	$D \geq 35$ / 36	87	32	0.00194	750	700
ANOVA	D = 36 / 36	34	512	0.02181	750	1000
ANOVA	D = 36 / 36, $C \leq 95$	31	256	0.01761	600	800
ANOVA	D = 36 / 36, $C \leq 85$	29	32	0.00260	700	700
ANOVA	D = 36 / 36, $C \leq 75$	21	256	0.02564	400	850
ANOVA	D = 36 / 36, $C \leq 65$	17	8	0.00031	1000	350
ANOVA	D = 36 / 36, $C \leq 55$	12	8	0.00050	350	750
ANOVA	D = 36 / 36, $C \leq 45$	10	4	0.00094	600	200
Peak	Top 30 per class	103	64	0.01039	700	650
Peak	Top 25 per class	95	256	0.03298	850	1000
Peak	Top 20 per class	83	64	0.00588	900	400
Peak	Top 15 per class	63	128	0.00702	700	1000
Peak	Top 10 per class	42	64	0.00444	850	700
Peak	Top 7 per class	30	256	0.01120	600	800
Peak	Top 5 per class	22	32	0.00141	600	550
Peak	Top 3 per class	14	128	0.01031	750	300
Peak	Ignoring classes	22	8	0.00050	350	750
Red.	R1	152	32	0.00231	350	1000
Red.	R2	121	64	0.00167	300	700
Red.	R3	96	64	0.00077	850	600
Red.	R4	76	64	0.00175	500	950
Red.	R5	60	256	0.01127	1000	600
Red.	R6	48	32	0.00127	650	900
Red.	R7	38	64	0.00077	850	600
Red.	R8	30	32	0.00183	250	950
Red.	R9	24	16	0.00052	850	450
Red.	R10	19	16	0.00095	650	500
Red.	R11	15	32	0.00052	350	1000
Red.	R12	12	32	0.00183	250	950
Red.	R13	9	8	0.00050	350	750

Table S8. Mean classification accuracy (MCA) and weighted F1 score (F1) based on the reduction variants, calculated directly from the baseline variant IGs without retraining (Method B) and reduction approach variants (Method I). V = Variant. Method = M. Input size = IS. Statistical significance was calculated for MCA and F1 in a joint analysis (α = 5 %). Significance letters are given in alphabetical ranges. Upper case letters follow lower case letters. All letters enclosed in the ranges belong to the same significance group. Different letters denote significant differences. Values with standard deviation, 5-fold cross-validated.

V	M	I	MCA [%]	Stat. sig.	F1 [%]	Stat. sig.
R1	B	152	85.3 ± 0.6	a	85.3 ± 0.6	a
R1	I	152	85.2 ± 0.6	a	85.3 ± 0.6	a
R2	B	121	84.6 ± 0.9	ab	84.6 ± 1.0	ab
R2	I	121	84.8 ± 0.5	ab	84.8 ± 0.6	ab
R3	B	96	84.1 ± 0.5	ab	84.1 ± 0.5	ab
R3	I	96	83.9 ± 0.7	ab	84.0 ± 0.6	ab
R4	B	76	82.9 ± 0.6	bc	83.0 ± 0.5	bc
R4	I	76	83.2 ± 0.7	bc	83.2 ± 0.5	bc
R5	B	60	80.8 ± 0.3	de	81.0 ± 0.2	de
R5	I	60	81.4 ± 0.7	cde	81.6 ± 0.7	cd
R6	B	48	79.6 ± 0.4	efgh	79.9 ± 0.4	defg
R6	I	48	79.9 ± 0.6	defg	80.1 ± 0.5	def
R7	B	38	77.8 ± 0.7	hi	78.2 ± 0.6	fgh
R7	I	38	77.8 ± 0.6	hi	78.0 ± 0.4	gh
R8	B	30	75.4 ± 0.6	jk	75.9 ± 0.5	ij
R8	I	30	75.4 ± 0.7	jk	75.9 ± 0.5	ij
R9	B	24	72.6 ± 0.8	l	73.2 ± 0.6	l
R9	I	24	73.1 ± 1.0	l	73.6 ± 1.0	kl
R10	B	19	65.3 ± 0.4	n	66.2 ± 0.4	n
R10	I	19	68.7 ± 0.8	m	69.3 ± 0.6	m
R11	B	15	60.3 ± 0.8	op	61.3 ± 0.7	o
R11	I	15	64.4 ± 0.5	n	65.3 ± 0.4	n
R12	B	12	56.5 ± 1.1	rs	57.2 ± 0.8	qr
R12	I	12	58.9 ± 0.9	pq	60.0 ± 0.8	op
R13	B	9	54.5 ± 2.1	t	55.3 ± 1.9	rst
R13	I	9	54.8 ± 0.3	st	55.4 ± 0.6	rst