

**Appendix 1 Supplementary equation****Equation S1**

$$\ln(p/(1-p)) = 8.368 - 94.112 \times \text{QSM\_IQR} + 0.004 \times \text{ADC\_P10} - 0.215 \times \text{Age}$$

Logistic regression equation of histogram features for the prediction of the isocitrate dehydrogenase (IDH) genotype. In the equation, p indicates the probability that IDH mutation is a case, whereas (1-p) indicates the probability that it is a non-case.

**Equation S2**

$$\ln(p/(1-p)) = 20.512 - 147.340 \times \text{QSM\_IQR} - 0.003 \times \text{ADC\_P10} - 0.286 \times \text{Age}$$

Logistic regression equation of histogram features for separating glioblastoma and astrocytoma. In the equation, p indicates the probability that glioblastoma is a case, whereas (1-p) indicates the probability that it is a non-case.

**Equation S3**

$$\ln(p/(1-p)) = 18.389 - 327.118 \times \text{QSM\_IQR} + 0.006 \times \text{ADC\_P10} - 0.351 \times \text{Age}$$

Logistic regression equation of histogram features for separating glioblastoma and oligodendroglioma. In the equation, p indicates the probability that glioblastoma is a case, whereas (1-p) indicates the probability that it is a non-case.

**Table S1** Evaluation of IDH genotypes and tumor subtypes of adult-type diffuse gliomas based on the CNS WHO classification 2021 using QSM histogram features

Histogram feature	IDH genotypes			Tumor subtypes						
	IDH-wildtype (n=27)	IDH-mutant (n=20)	P	Glioblastoma (n=23)	Astrocytoma (n=14)	Oligodendroglioma (n=6)	P	P <sup>1</sup>	P <sup>2</sup>	P <sup>3</sup>
P10 ( $\times 10^2$ )	-3.54 (-4.58, -2.68)	-2.42 (-3.09, -1.72)	0.016*	-3.54 (-4.52, -2.57)	-2.30 (-3.78, -1.56)	-2.63 (-2.87, -1.81)	0.084	NA	NA	NA
P90 ( $\times 10^2$ )	3.74 (2.53, 5.26)	2.09 (1.77, 2.96)	0.007*	3.74 (2.53, 5.04)	2.09 (1.75, 3.41)	2.29 (1.88, 2.76)	0.024*	0.060	0.062	0.934
IQR ( $\times 10^2$ )	3.47 (2.64, 4.50)	2.30 (1.74, 2.82)	0.001*	3.47 (2.76, 4.40)	2.18 (1.76, 3.12)	2.40 (1.72, 2.78)	0.008*	0.020*	0.030*	0.741
Kurtosis ( $\times 10^{-1}$ )	0.88 (0.60, 1.40)	0.97 (0.80, 1.16)	0.451	0.88 (0.60, 1.40)	0.84 (0.79, 1.11)	1.58 (0.85, 3.18)	0.189	NA	NA	NA
Maximum ( $\times 10^1$ )	3.46 (1.96, 5.00)	1.90 (1.53, 2.78)	0.037*	3.41 (1.96, 4.24)	1.94 (1.41, 2.66)	1.79 (1.71, 2.90)	0.157	NA	NA	NA
MAD ( $\times 10^2$ )	2.38 (1.82, 3.14)	1.50 (1.16, 1.93)	0.003*	2.38 (1.82, 3.11)	1.41 (1.08, 2.29)	1.60 (1.27, 1.79)	0.017*	0.036*	0.045*	0.564
Mean ( $\times 10^3$ )	1.29 (-1.79, 4.47)	-0.37 (-1.45, 0.30)	0.121	1.36 (-1.60, 4.47)	-0.49 (-1.33, 0.25)	-0.26 (-1.57, 0.35)	0.195	NA	NA	NA
Median ( $\times 10^3$ )	-1.49 (-3.91, 0.18)	-0.72 (-2.91, 0.29)	0.389	-0.77 (-3.12, 0.82)	-1.11 (-5.43, 0.13)	-0.13 (-2.41, 0.48)	0.800	NA	NA	NA
Minimum ( $\times 10^1$ )	-1.47 (-2.03, -1.14)	-1.37 (-2.50, -0.96)	0.763	-1.47 (-2.03, -1.14)	-1.15 (-1.72, -0.67)	-2.24 (-3.50, -1.39)	0.108	NA	NA	NA
RMS ( $\times 10^2$ )	3.16 (2.76, 4.64)	2.09 (1.70, 2.73)	0.005*	3.16 (2.76, 4.41)	1.92 (1.38, 3.36)	2.29 (1.99, 2.45)	0.026*	0.078	0.047*	0.509
Skewness	1.17 (0.26, 1.70)	0.42 (0.24, 1.36)	0.212	1.17 (0.35, 1.67)	0.57 (0.25, 1.42)	0.39 (-0.98, 0.59)	0.316	NA	NA	NA
Variance ( $\times 10^3$ )	1.00 (0.66, 2.13)	0.43 (0.28, 0.75)	0.006*	1.00 (0.66, 1.92)	0.37 (0.19, 1.13)	0.52 (0.39, 0.60)	0.029*	0.084	0.054	0.509

Values are presented as median (inter-quartile range). \*, represents a statistical difference ( $P < 0.05$ ). P<sup>1</sup>, P<sup>2</sup> and P<sup>3</sup> are respectively the P values for glioblastoma vs. astrocytoma, glioblastoma vs. oligodendroglioma, and astrocytoma vs. oligodendroglioma, and corrected for multiple comparisons using the Benjamini-Hochberg method. IDH, isocitrate dehydrogenase; CNS WHO classification 2021, the 2021 World Health Organization Classification of Tumors of the Central Nervous System; QSM, quantitative susceptibility mapping; P10, 10th percentile; P90, 90th percentile; IQR, interquartile range; MAD, mean absolute deviation; RMS, root mean squared.

**Table S2** Evaluation of IDH genotypes and tumor subtypes of adult-type diffuse gliomas based on the CNS WHO classification 2021 using ADC histogram features

Histogram feature	IDH genotypes			Tumor subtypes						
	IDH-wildtype (n=27)	IDH-mutant (n=20)	P	Glioblastoma (n=23)	Astrocytoma (n=14)	Oligodendroglioma (n=6)	P	P <sup>1</sup>	P <sup>2</sup>	P <sup>3</sup>
P10 ( $\times 10^{-3}$ )	0.84 (0.78, 0.96)	0.98 (0.91, 1.07)	0.004*	0.85 (0.80, 0.99)	0.94 (0.91, 1.05)	1.05 (0.98, 1.13)	0.021*	0.115	0.053	0.096
P90 ( $\times 10^{-3}$ )	1.52 (1.31, 1.66)	1.72 (1.56, 1.76)	0.060	1.57 (1.31, 1.72)	1.73 (1.60, 1.93)	1.60 (1.49, 1.72)	0.239	NA	NA	NA
IQR ( $\times 10^{-2}$ )	2.92 (2.24, 3.96)	3.55 (2.55, 4.13)	0.406	2.93 (2.24, 4.43)	3.95 (3.21, 4.44)	2.55 (2.46, 3.04)	0.172	NA	NA	NA
Kurtosis ( $\times 10^1$ )	5.65 (3.63, 9.70)	4.98 (3.95, 6.45)	0.574	5.44 (3.58, 9.70)	4.56 (3.86, 6.30)	6.05 (4.03, 7.35)	0.712	NA	NA	NA
Maximum ( $\times 10^{-3}$ )	2.64 (2.39, 3.33)	2.73 (2.37, 3.23)	0.769	2.64 (2.41, 3.32)	2.73 (2.41, 3.64)	2.68 (2.33, 2.82)	0.842	NA	NA	NA
MAD ( $\times 10^{-3}$ )	1.95 (1.63, 2.63)	2.12 (1.66, 2.55)	1.000	1.93 (1.63, 3.09)	2.30 (2.12, 2.87)	1.68 (1.53, 1.97)	0.239	NA	NA	NA
Mean ( $\times 10^{-2}$ )	1.21 (1.01, 1.32)	1.30 (1.24, 1.40)	0.020*	1.26 (1.03, 1.34)	1.30 (1.23, 1.42)	1.32 (1.25, 1.40)	0.198	NA	NA	NA
Median ( $\times 10^{-3}$ )	1.17 (1.00, 1.28)	1.28 (1.20, 1.39)	0.022*	1.23 (1.00, 1.30)	1.27 (1.13, 1.41)	1.29 (1.22, 1.38)	0.173	NA	NA	NA
Minimum ( $\times 10^{-2}$ )	5.48 (0.00, 5.78)	0.00 (0.00, 5.91)	0.391	5.62 (0.00, 5.94)	0.00 (0.00, 6.09)	0.00 (0.00, 0.00)	0.425	NA	NA	NA
RMS ( $\times 10^{-3}$ )	1.24 (1.05, 1.38)	1.34 (1.27, 1.43)	0.026*	1.28 (1.05, 1.41)	1.34 (1.28, 1.44)	1.34 (1.27, 1.43)	0.205	NA	NA	NA
Skewness	1.12 (0.41, 1.83)	0.58 (0.04, 0.82)	0.017*	1.06 (0.41, 1.79)	0.58 (0.02, 1.13)	0.50 (0.07, 0.73)	0.075	NA	NA	NA
Variance ( $\times 10^{-5}$ )	0.63 (0.45, 1.22)	0.74 (0.44, 1.05)	0.922	0.55 (0.45, 1.18)	0.91 (0.64, 1.32)	0.52 (0.40, 0.69)	0.317	NA	NA	NA

Values are presented as median (inter-quartile range). \*, represents a statistical difference ( $P < 0.05$ ). P<sup>1</sup>, P<sup>2</sup> and P<sup>3</sup> are respectively the P values for glioblastoma vs. astrocytoma, Glioblastoma vs. oligodendroglioma, and astrocytoma vs. oligodendroglioma, and corrected for multiple comparisons using the Benjamini-Hochberg method. IDH, isocitrate dehydrogenase; CNS WHO classification 2021, the 2021 World Health Organization Classification of Tumors of the Central Nervous System; ADC, apparent diffusion coefficient; P10, 10th percentile; P90, 90th percentile; IQR, interquartile range; MAD, mean absolute deviation; RMS, root mean squared.

**Table S3** Correlation between Ki-67 and histogram features of QSM and ADC

Histogram feature	QSM		ADC	
	rho	P	rho	P
P10	-0.452	0.001**	-0.554	<0.001**
P90	0.515	<0.001**	0.016	0.917
IQR	0.531	<0.001**	0.262	0.089
Kurtosis	0.171	0.251	-0.211	0.175
Maximum	0.494	<0.001**	0.001	0.993
MAD	0.523	<0.001**	0.296	0.054
Mean	0.237	0.108	-0.216	0.163
Median	-0.144	0.333	-0.273	0.076
Minimum	-0.254	0.085	-0.142	0.362
RMS	0.522	<0.001**	-0.147	0.348
Skewness	0.407	0.005*	0.187	0.230
Variance	0.526	<0.001**	0.325	0.033*

\*, P<0.05, \*\*, P<0.001. QSM, quantitative susceptibility mapping; ADC, apparent diffusion coefficient; P10, 10th percentile; P90, 90th percentile; IQR, interquartile range; MAD, mean absolute deviation; RMS, root mean squared.