

Supplementary Table S1. Market price and number of grains of eight types of rice varieties

S. No.	Rice variety	Sample nomenclature	Market price (in INR Per kg)	Count of individual grain images
1	Traditional Basmati	BM	78.0	295
2	Eco Kolam	EK	39.5	233
3	HMT Kolam	HK	45.5	363
4	Kana Basmati	KB	32.5	521
5	Sona Masuri	SM	30.5	402
6	Tibar Basmati	TB	61.5	431
7	Tukda Basmati	TKB	44.5	398
8	Wada Kolam	WK	48.5	438

Supplementary Table S2. Geometrical and morphological features of rice grains

S. No.	Feature	Symbol	Mathematical Expression
1	Area	A	-
2	Perimeter	P	-
3	Area of bounding ellipse	$A_{ellipse}$	$(\pi/4)L_{major}L_{minor}$
4	Length of major axis of ellipse	L_{major}	-
5	Length of minor axis of ellipse	L_{minor}	-
6	Eccentricity of bounding ellipse	e	-
7	Aspect ratio	AR	L_{major}/L_{minor}
8	Area of bounding rectangle	$A_{rectangle}$	-
9	Area of convex hull	A_{hull}	-
10	Extent	E	$A_{rectangle}/A$
11	Solidity	S	A_{hull}/A
12	Roundness	R	$4\pi A/P^2$
13	Equivalent diameter	D_{eq}	$\sqrt{4A/\pi}$
14	Compactness	C	D_{eq}/L_{major}
15	Shape factor 1	SF_1	L_{major}/A
16	Shape factor 2	SF_2	L_{minor}/A
17	Shape factor 3	SF_3	$A/\pi L_{major}^2$
18	Shape factor 4	SF_4	$A/\pi L_{minor}L_{major}$

Supplementary Table S3. Summary of feature dataset

Feature type	Symbol	Count
Geometrical and morphological	Listed in Table 2	18
Textural	$CORR_i, CON_i, DIS_i, ASM_i, EN_i, HO_i$ for $i \in [0^\circ, 45^\circ, 90^\circ, 135^\circ]$	24
Color	$R_i, G_i, B_i, H_i, S_i, V_i$ where $i \in [0, 46]$	282

Supplementary Table S4. Number of actual versus the predicted grains in the validation samples

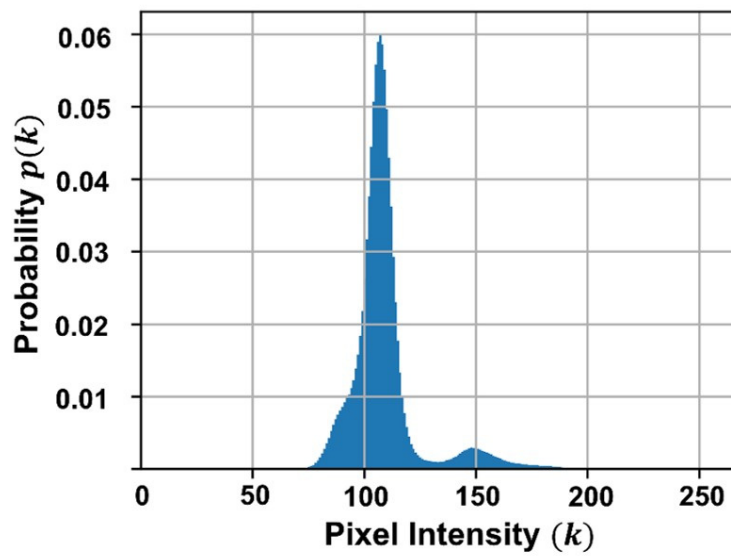
Number of actual (A) and predicted (P) grains								
Rice type	Sample 1		Sample 2		Sample 3		Sample 4	
	A	P	A	P	A	P	A	P
BM	50	41	0	7	0	0	50	39
EK	0	0	0	3	30	33	0	5
HK	0	2	0	3	0	4	0	3
KB	0	0	30	26	0	1	0	0
SM	0	1	0	5	0	3	0	9
TB	30	29	50	23	0	0	0	9
TKB	0	3	0	5	0	0	30	8
WK	0	0	0	0	50	38	0	2

Supplementary Table S5. Confusion matrix for the Random Forest classifier

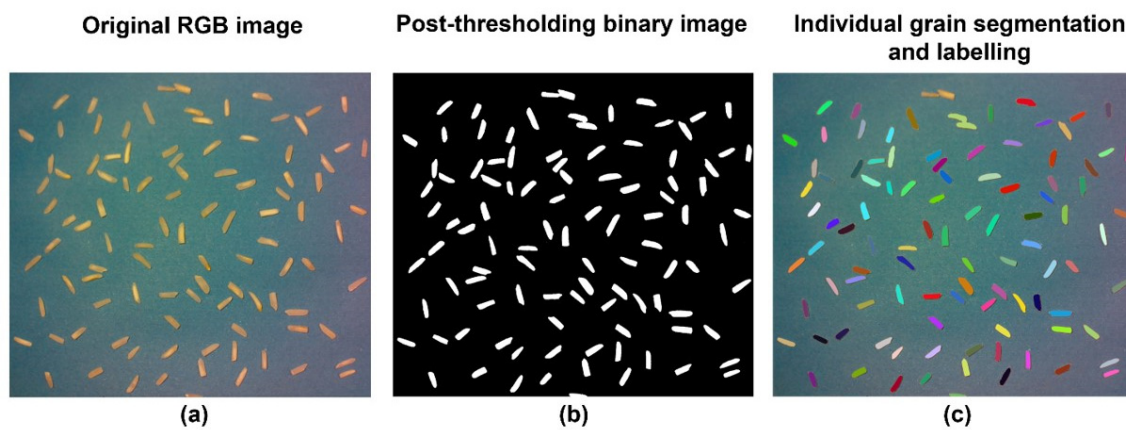
		True label							
		BM	EK	HK	KB	SM	TB	TKB	WK
Predicted label	BM	56	0	0	0	0	3	0	0
	EK	0	33	3	0	4	0	8	4
	HK	0	5	35	0	3	0	5	14
	KB	0	0	0	109	3	0	3	1
	SM	0	1	0	6	70	0	6	0
	TB	7	0	3	0	2	47	4	0
	TKB	0	1	9	3	4	9	56	2
	WK	0	2	9	2	3	0	1	62

BM, Basmati; EK, Eco Kolam; HK, HMT Kolam; KB, Kana Basmati; SM, Sona Masuri; TB, Tibar Basmati; TKB, Tukda Basmati; WK, Wada Kolam.

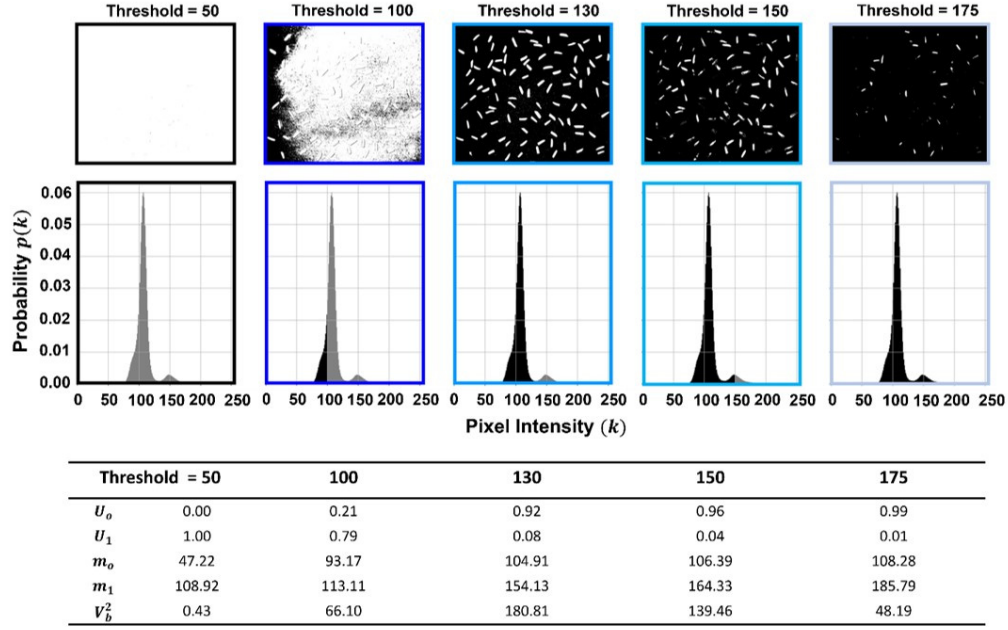
Figure captions



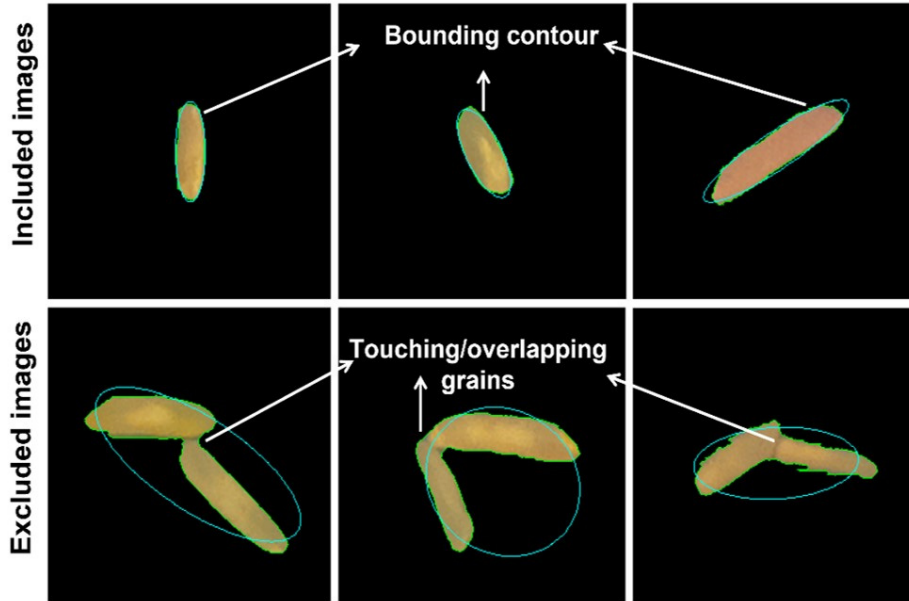
Supplementary Figure S1. The histogram for a representative gray scale image of rice grains.



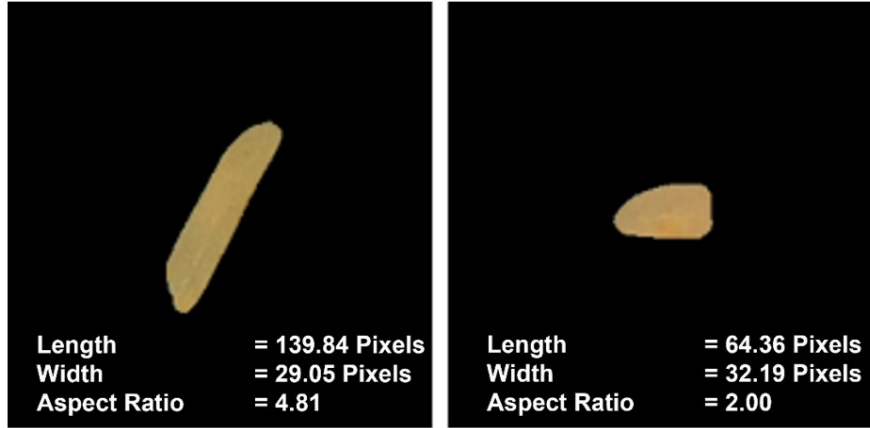
Supplementary Figure S2. Images of rice grains: (a) original RGB format, (b) gray scale format after global thresholding, and (c) individual labelled rice grains obtained using the Watershed algorithm.



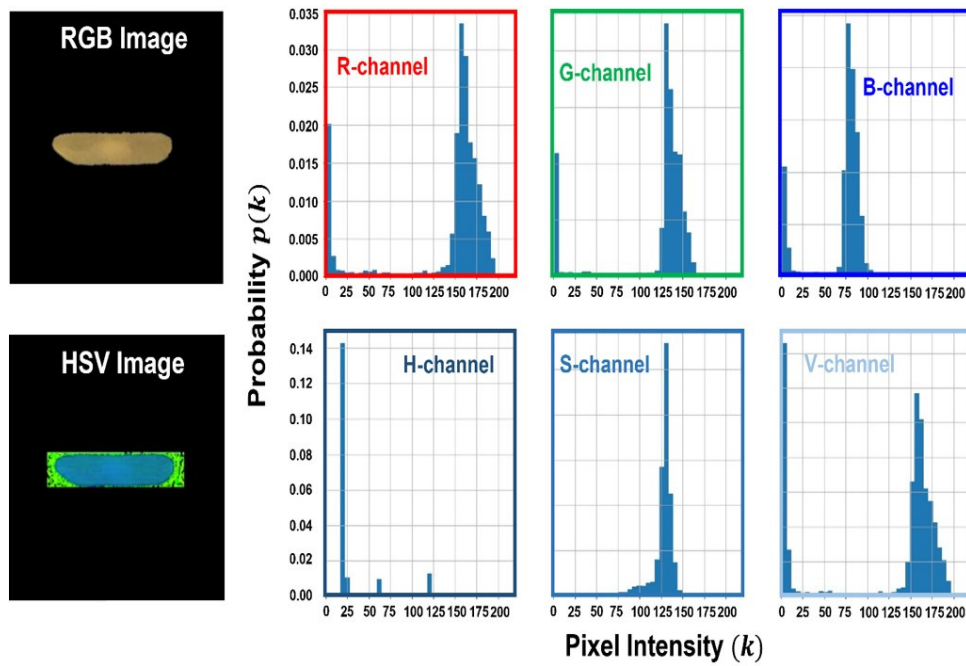
Supplementary Figure S3. Estimation of global threshold value using Otsu's technique: (Top) Grayscale images of rice grains at different levels of thresholding. The corresponding histograms are shown below each image. (Bottom) The parameters used for obtaining the threshold values are tabulated.



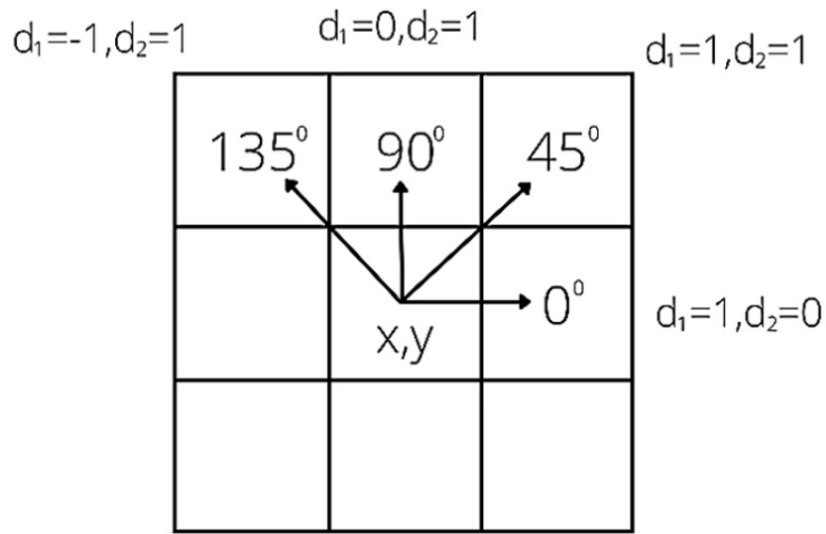
Supplementary Figure S4. Representative images of the segmented rice grains: (Top row) images of individual rice grains with bounding contours that were selected for image dataset. (Bottom row) images of rice grains that are overlapping/touching, and therefore, omitted from the dataset.



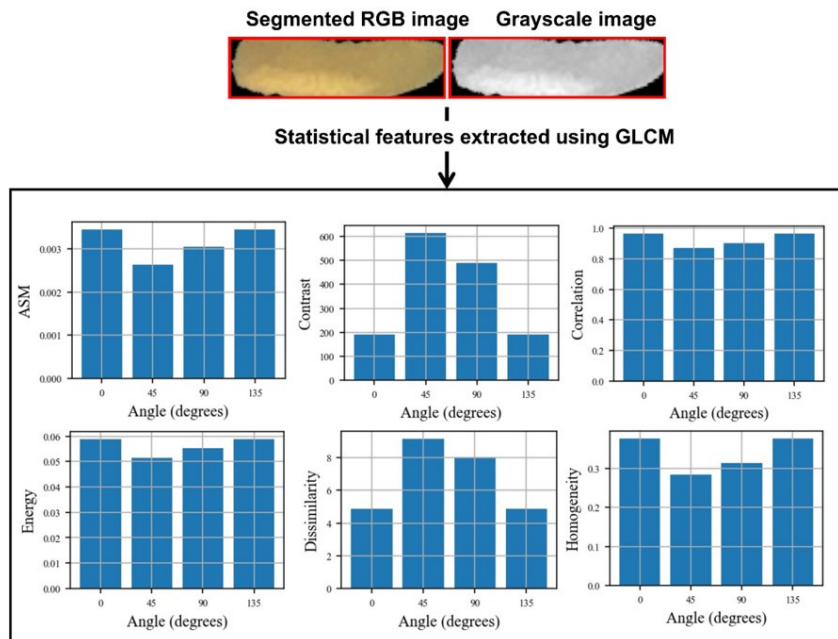
Supplementary Figure S5. Representative images showing selective geometrical features (length, width and aspect ratio) calculated for segmented rice grains.



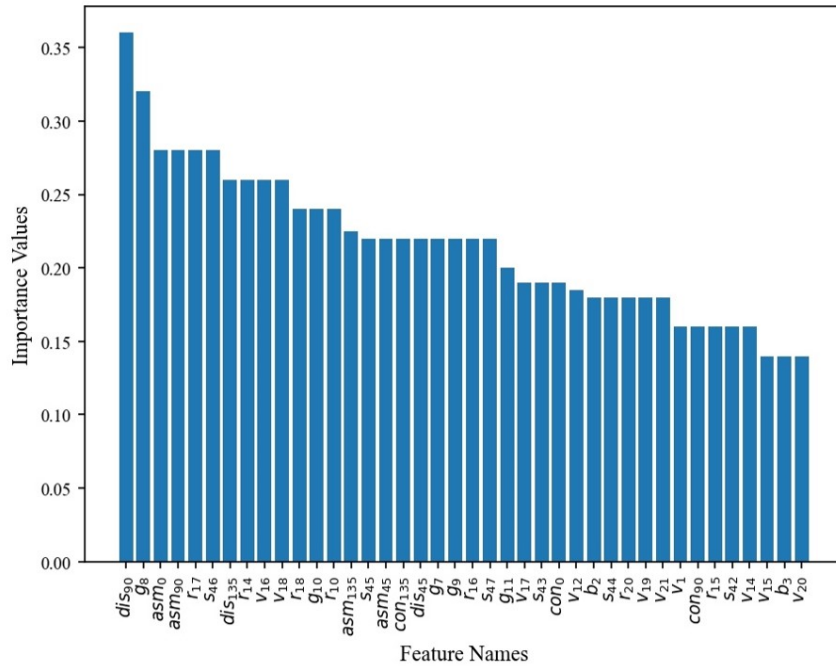
Supplementary Figure S6. (Left) RGB and HSV images of a segmented rice grain. (Right) histograms corresponding to the R, G, B channels (top row), and H, S, V channels (bottom row).



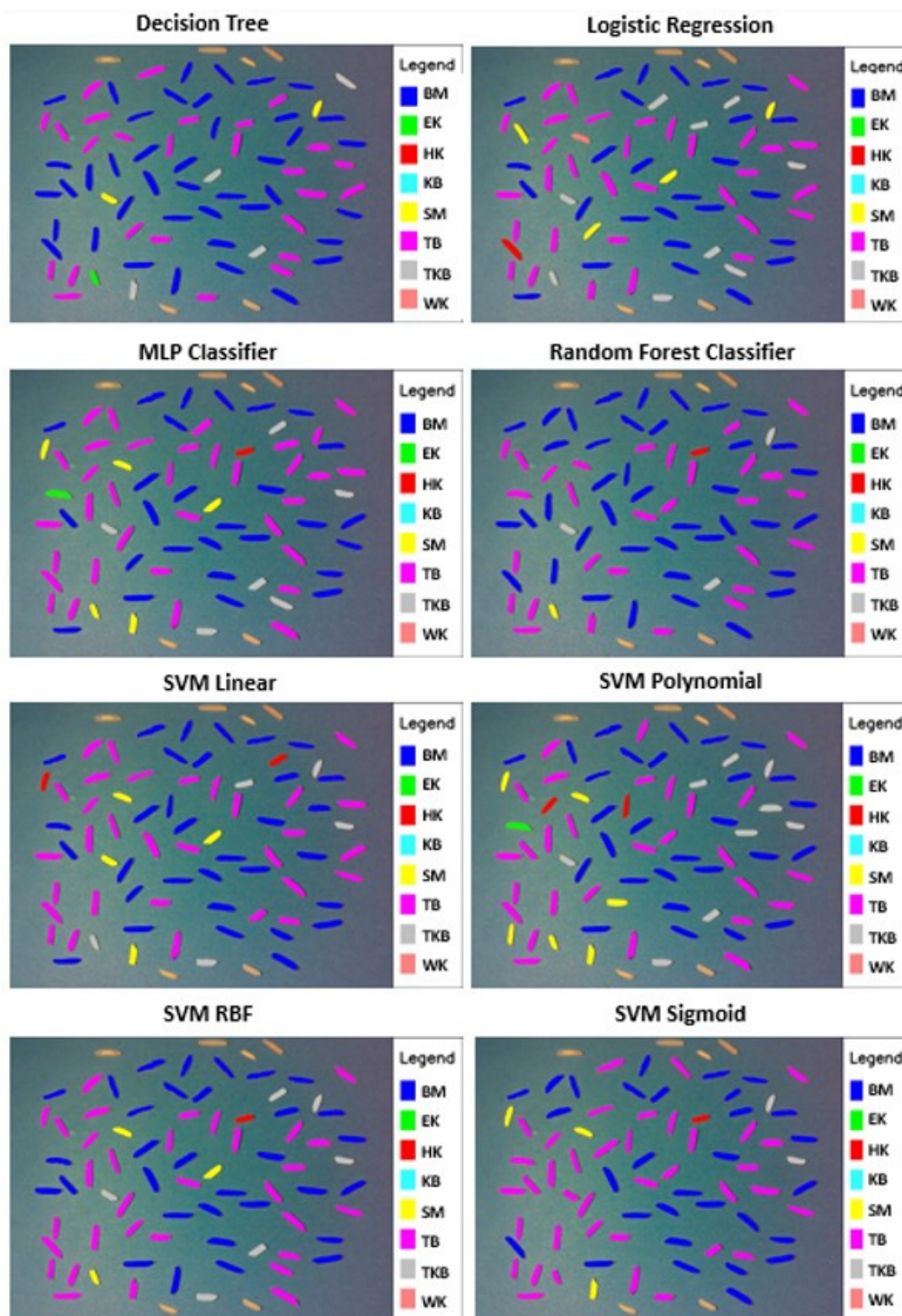
Supplementary Figure S7. Coordinate frame with the direction of analysis.



Supplementary Figure S8. Statistical features (ASM, Contrast, Correlation, Energy, Dissimilarity, and Homogeneity) extracted using the GLCM for a representative segmented rice grain image.



Supplementary Figure S9. Key features and their magnitude in terms of their importance value.



Supplementary Figure S10. Labelled rice grain images with different machine learning models, which shows a qualitative comparison between the models.