

## Supplementary Materials

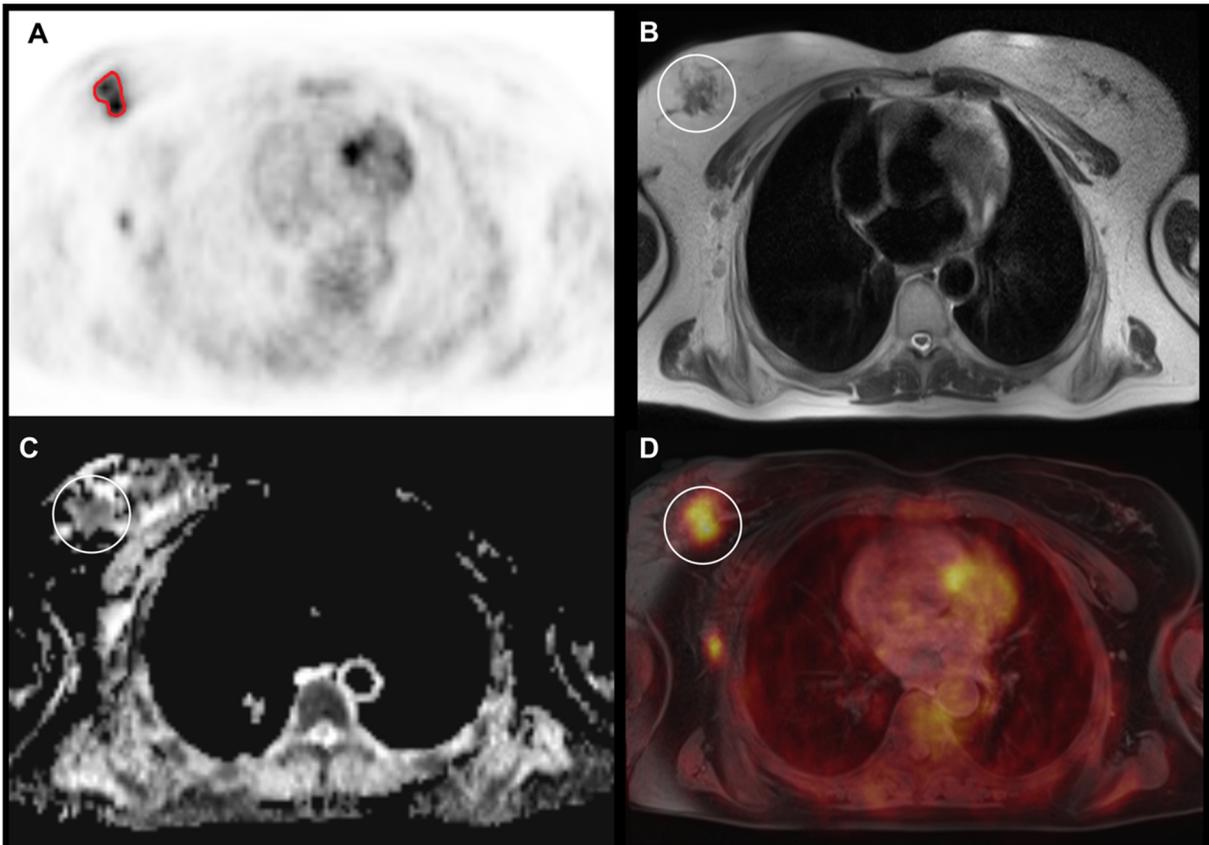
**Table S1:** Description of Radiomic Features.

Feature Classes	Imaging Techniques	Counts	Notes
First Order	ADC-MRI without contrast agent	5	Exhibits voxel alone based statistical features.
	T2w-MRI (T2)	5	
	T1w-MRI post-contrast agent injection (T1C)	5	
	PET	5	
Second Order	T2w-MRI (T2)	19	Describes surface texture.
	T1w-MRI post-contrast agent injection (T1C)	19	
SUV	PET	16	The standard uptake value (SUV), also known as standardized uptake value, is a simple way of determining activity in PET imaging.
<b>Total</b>		74	

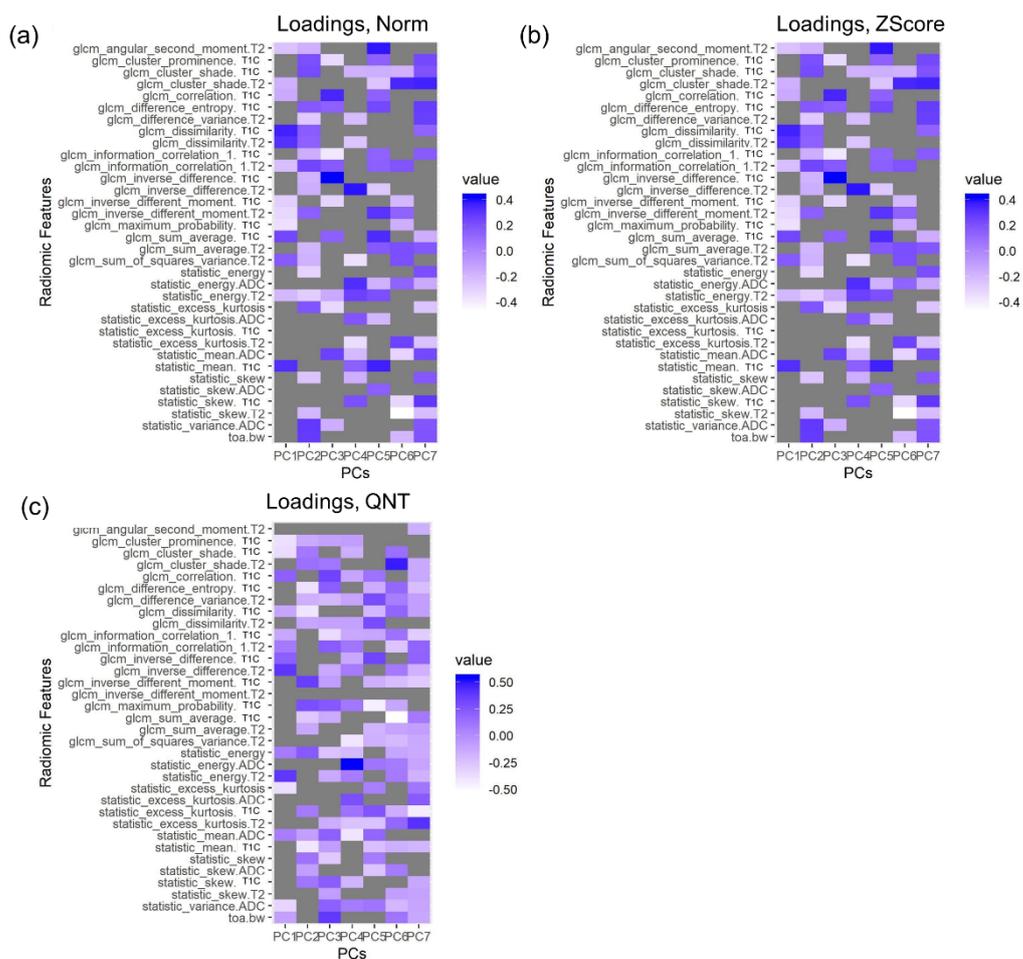
**Table S2: Modelling Performance to Detect Tumor Subtypes (Luminal A and B)**

<b>Modelling performance with PC6 (non-normalized)</b>					
	<b>Sensitivity</b>	<b>Specificity</b>	<b>Accuracy</b>	<b>Sensitivity+Specificity</b>	<b>AUC</b>
<b>LDA</b>	67%	49%	58%	1.16	59%
<b>RF</b>	89%	16%	52%	1.05	69%
<b>LogistBoost</b>	83%	24%	54%	1.07	54%
<b>Modelling performance with PC6 (z-score)</b>					
	<b>Sensitivity</b>	<b>Specificity</b>	<b>Accuracy</b>	<b>Sensitivity+Specificity</b>	<b>AUC</b>
<b>LDA</b>	67%	42%	55%	1.09	60%
<b>RF</b>	89%	17%	53%	1.06	75%
<b>LogistBoost</b>	90%	14%	52%	1.04	52%
<b>Modelling performance with PC3 (Quartile)</b>					
	<b>Sensitivity</b>	<b>Specificity</b>	<b>Accuracy</b>	<b>Sensitivity+Specificity</b>	<b>AUC</b>
<b>LDA</b>	80%	53%	66%	1.33	73%
<b>RF</b>	88%	24%	56%	1.12	75%
<b>LogistBoost</b>	79%	36%	57%	1.15	57%
<b>Modelling performance with PC4 (Quartile)</b>					
	<b>Sensitivity</b>	<b>Specificity</b>	<b>Accuracy</b>	<b>Sensitivity+Specificity</b>	<b>AUC</b>
<b>LDA</b>	78%	45%	62%	1.23	63%
<b>RF</b>	91%	26%	58%	1.17	76%
<b>LogistBoost</b>	83%	30%	56%	1.13	56%

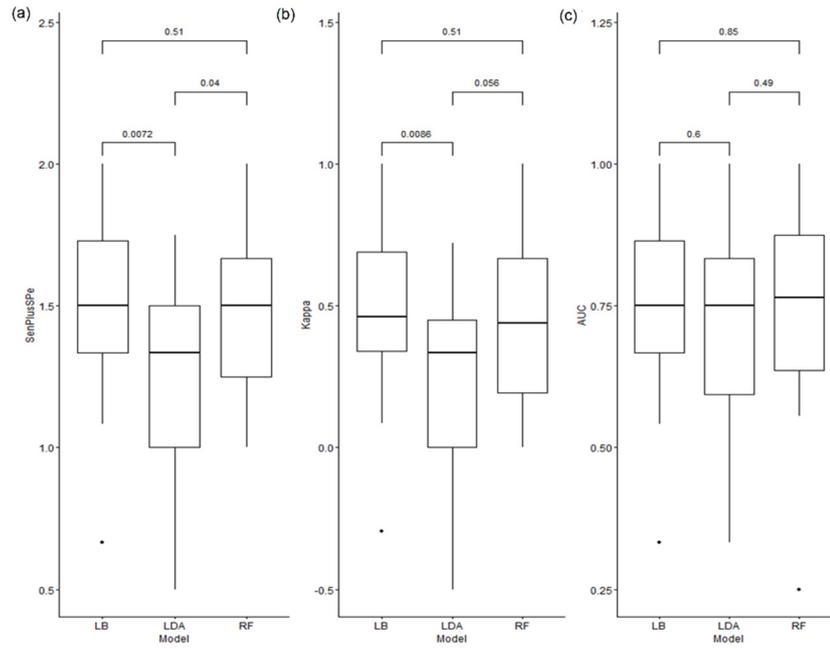
AUC: Area Under the Curve; LDA: Linear Discriminant Analysis; RF: Random Forest.



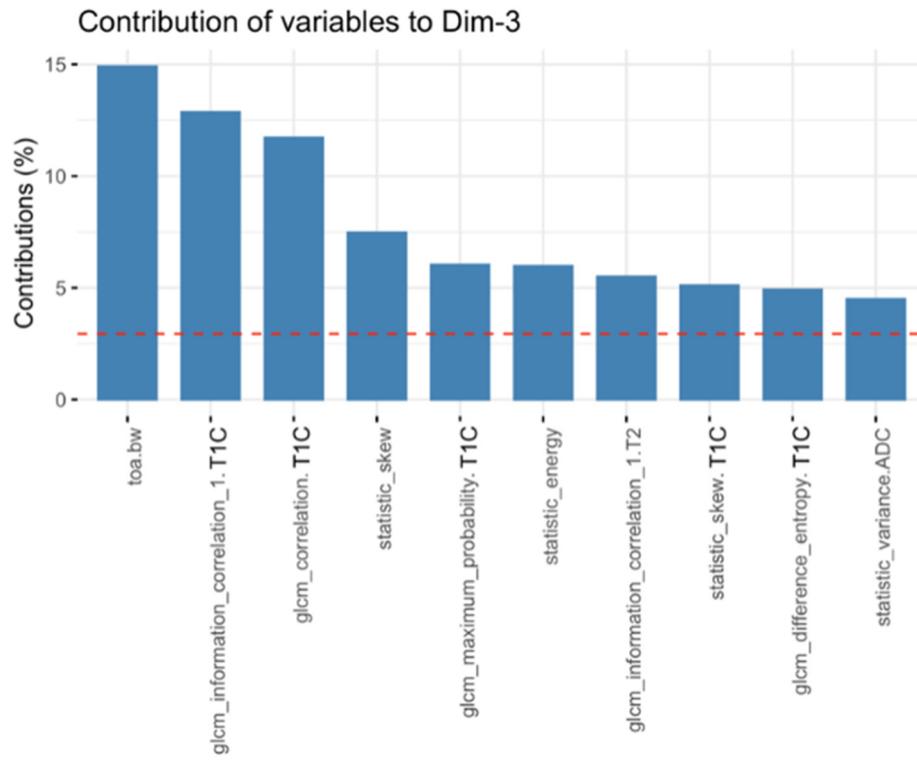
**Supplementary Figure S1.**  $^{18}\text{F}$ -FDG-PET/MRI scan Images of a 63-year-old patient with a breast heteroplastic process on the right breast. The white circle indicates the lesion: (A) PET image showing uptake after 60 minutes of a segmented lesion (red depicted); (B) Lesion revealed on T2 weighted image (T2WI) acquired on the axial plane; (C) hypointensity of the lesion on apparent diffusion coefficient (ADC) map; (D)  $^{18}\text{F}$ -FDG-PET/MRI fusion image.



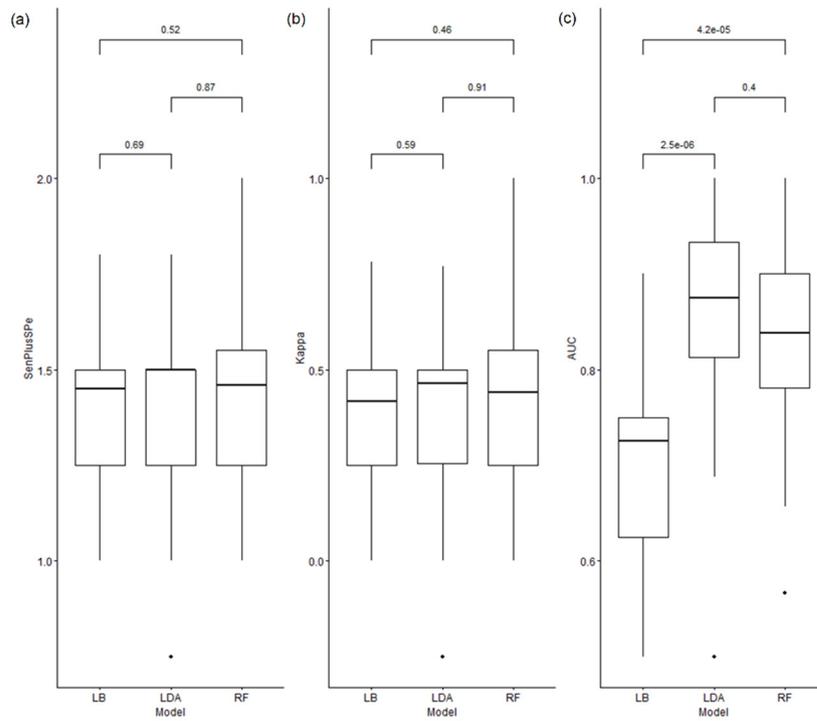
**Supplementary Figure S2.** Loadings Plots for 3 datasets. Highlighted boxes are above the 3<sup>rd</sup> quantile threshold. (a) Normalize only as ratio of malignant and healthy radiomic features; (b) Z-Score; (c) Quantile.



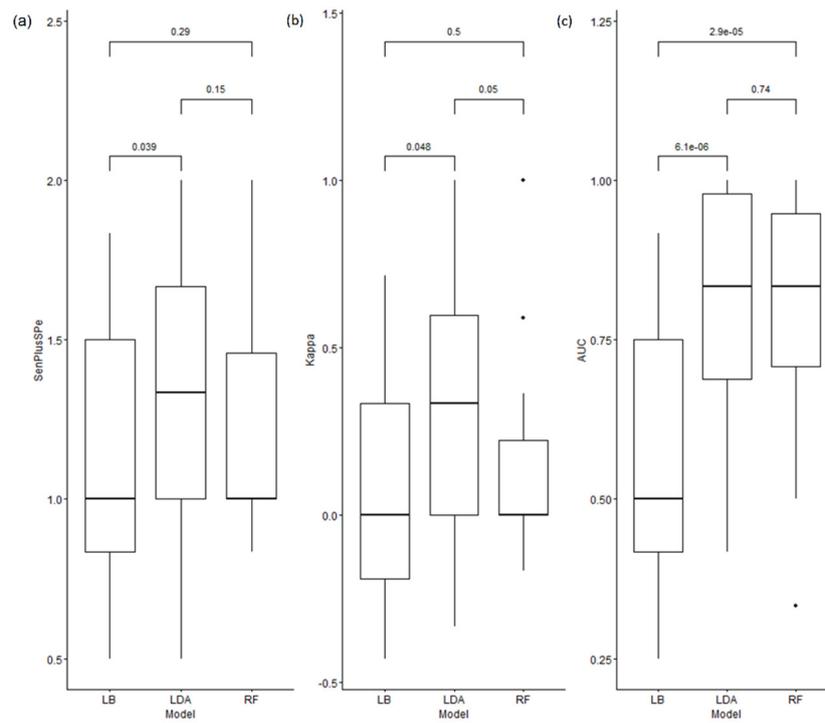
**Supplementary Figure S3.** Comparison among models (LB: LogistBoost, LDA: Linear decision Analysis, RF: Random Forest) used to classify tumor grade. (a) Boxplot of Sensitivity+Specificity value. (b) Boxplot of Cohen's Kappa. (c) Boxplot of AUC values.



Supplementary Figure S4. PC3 Quantile. Top 10 variable contribution.



**Supplementary Figure S5.** Comparison among models (LB: LogistBoost, LDA: Linear decision Analysis, RF: Random Forest) used to classify high and low value of KI\_67. (a) Boxplot of Sensitivity+Specificity value. (b) Boxplot of Cohen's Kappa. (c) Boxplot of AUC values.



**Supplementary Figure S6.** Comparison among models (LB: LogistBoost, LDA: Linear decision Analysis, RF: Random Forest) used to classify tumor subtype. (a) Boxplot of Sensitivity+Specificity value. (b) Boxplot of Cohen's Kappa. (c) Boxplot of AUC values.