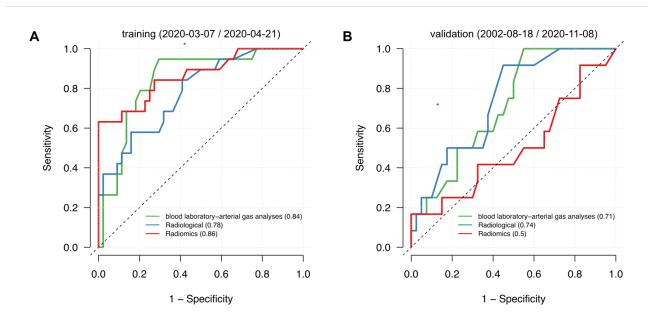
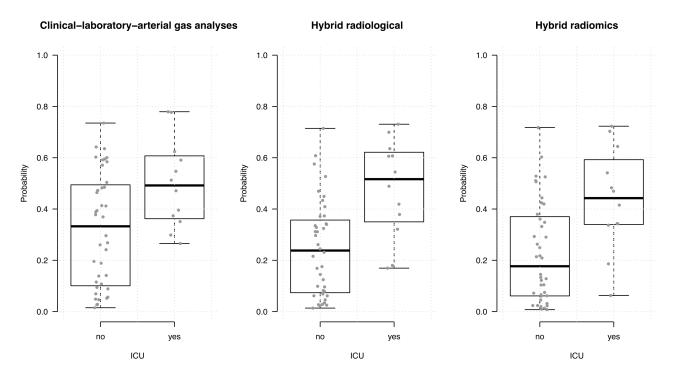


Suppl. Fig. 1 Example of segmentation of CT images. Well-Areated Lung (WAL) area are depicted in purple (right lung) and orange (left lung), Ground Glass Opacities (GGO) area are depicted in blue (right lung) and light blue (left lung) and Consolidation area (Consolid) are depicted in green (right lung) and light green (left lung).



Supplementary Fig. 2. Performance of 3 simple models in predicting ICU admission. Receiving Operating Characteristic (ROC) curve analysis of the blood laboratory-arterial gas analyses features (green line), radiological features (sky blue line) and radiomics features (red line) in the training (A) and validation (B) sets. The values reported in parentheses refer to Area Under the ROC curves.



Supplementary Fig. 3. Box plots of the distribution of the probability of ICU admission estimated using the blood laboratory-arterial gas analyses (left), Hybrid radiological (middle) and Hybrid radiomics (right) models in the patients of the validation set who were not admitted (ICU=no) or required admission (ICU=yes) to ICU. No patient with estimated probability below 0.25 (laboratory-arterial gas analyses model), 0.15 (Hybrid radiology model) and 0.05 (Hybrid radiomic model) required ICU admission.

## **Supplementary Table 1.** Radiomic features for image texture analysis extracted using the 3DSlicer software and the module radiomic.

			1	1			
							Selecte
							d in
			Selected in				Hybrid
			Clinical-	Selected		Selected	radiolo
			laboratory-	in		in Hybrid	-
			arterial gas	Radiologi	Selected in	radiologi	radiomi
Parameter type	Parameter name	Description	analysis	cal	Radiomics	cal	c
		years of age at admission to the					
Clinical-laboratory-arterial gas analysis	Age	Emergency Room	Х			х	
		the Horowitz (P/F) Index is					
		calculated as the ratio between the					
		arterial partial pressure of oxygen					
		[PaO2] measured(in mmHg) by					
		blood gas analysis and fraction of					
Clinical-laboratory-arterial gas analysis	P/F	inspired oxygen [FiO2]	х			х	х
Oliviaal laboratory, arterial and analysis	LDH	een ma leetete debudueeenee (111/1)	v			v	х
Clinical-laboratory-arterial gas analysis		serum lactate dehydrogenase (UI/L)	^			х	^
Clinical-laboratory-arterial gas analysis	D-dimer	D-dimer (µg/mL FEU)					
Clinical-laboratory-arterial gas analysis	PCR	C-Reactive Protein (mg/dL)					
Clinical-laboratory-arterial gas analysis	Lymphocytes	Blood lymphocytes count (103/uL)					
		corresponds to % of the volume of					
		areas of consolidated lung tissue					
		after manually corrected software					
Radiological	% Consolid	segmentation of chest CT images		х		х	х
		corresponds to % volume of areas					
		of ground glass opacities in the lung					
		after software segmentation of					
Radiological	% Ground Glass	chest CT images					
		corresponds to % of the volume of					
		areas of normally areated lung					
		tissue after software segmentation					
Radiological	% Normal lung	of chest CT images		х			
		the variance in gray level intensities					
Radiomics	GrayLevelVariance	for the zones					
		Measures the distribution of the					
		higher gray-level values, with a					
		higher value indicating a greater					
	HighGrayLevelEmphasi	concentration of high gray-level					
Radiomics	s	values in the image.					
		Measures the					
		uncertainty/randomness in					
Radiomics	DependenceEntropy	dependence.	ļ				
		Measures the similarity of					
		dependence throughout the image,					
		with a lower value indicating more					
Dedication		homogeneity among dependencies			×		
Radiomics	ity	in the image.	ļ		Х		
		Modeuroe the similarity of any lavel					
		Measures the similarity of gray-level intensity values in the image, where					
	GrayLevelNonUniformit	a lower GLN value correlates with a					
Radiomics	y	greater similarity in intensity values.					
	3						
		A measure of the distribution of					
		small dependencies, with a greater					
	SmallDependoncoEmph	value indicative of smaller dependence and less homogeneous					
Radiomics	asis	textures.					
	2010						
	SmallDopondoreal list O	Measures the joint distribution of					
Radiomics		small dependence with higher gray-			х		
Radiomics	rayLevelEmphasis	level values.			^		

	1		1	1	
		Measures the similarity of			
		dependence throughout the image,			
		with a lower value indicating more			
		homogeneity among dependencies			
	DependenceNonUniform	in the image. This is the normalized			
Radiomics	ityNormalized	version of the DLN formula.			
		A measure of the distribution of			
		large dependencies, with a greater			
		value indicative of larger			
	LargeDependenceEmph				
Radiomics	asis	, homogeneous textures.			
	LargeDependenceLowG	-			
Radiomics	rayLevelEmphasis	Emphasis (LDLGLE)		х	х
	ray zoroizmphablo	Measures the variance in		~	~
Radiomics	DependenceVariance	dependence size in the image.			
Radiomics	Dependencevariance				
		Measures the joint distribution of			
	LargeDependenceHighG				
Radiomics	rayLevelEmphasis	level values.			
		Measures the joint distribution of			
	SmallDependenceLowG	small dependence with lower gray-			
Radiomics	rayLevelEmphasis	level values.			
		Measures the distribution of low	 1		
		gray-level values, with a higher			
		value indicating a greater			
		concentration of low gray-level			
Radiomics	LowGrayLevelEmphasis	• •			
Tradio mes	LoworayLevelEmphasis	÷			
Dadiensiae	Loint A. Jonana	Returns the mean gray level			
Radiomics	JointAverage	intensity of the distribution			
		Measures the relationship between			
		occurrences of pairs with lower			
		intensity values and occurrences of			
Radiomics	SumAverage	pairs with higher intensity values.			
		A measure of the			
		randomness/variability in			
Radiomics	JointEntropy	neighborhood intensity values.			
		A measure of the skewness and			
		uniformity of the GLCM. A higher			
		cluster shade implies greater			
Radiomics	ClusterShade	asymmetry about the mean.			
Tradio mes	Cluster Of lade				
		Indicates the occurrences of the			
L		most predominant pair of			
Radiomics	MaximumProbability	neighboring intensity values.			
		Inverse Difference Moment			
		Normalized is a measure of the			
Radiomics	Idmn	local homogeneity of an image.			
		A measure of homogeneous			
		patterns in the image. A greater			
		Energy implies that there are more			
		instances of intensity value pairs in			
		the image that neighbor each other			
Radiomics	JointEnergy	at higher frequencies.			
		A measure of the local intensity			
				1	
		variation, favoring values away from			
		variation, favoring values away from the diagonal i=j. A larger value			
		variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in			
Radiomics	Contrast	variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring			
Radiomics	Contrast	variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels.			
Radiomics	Contrast	variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels. A measure of the			
Radiomics	Contrast	variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels. A measure of the randomness/variability in			
		variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels. A measure of the randomness/variability in neighborhood intensity value			
Radiomics	Contrast DifferenceEntropy	variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels. A measure of the randomness/variability in			
		variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels. A measure of the randomness/variability in neighborhood intensity value			
		variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels. A measure of the randomness/variability in neighborhood intensity value differences.			
		variation, favoring values away from the diagonal i=j. A larger value correlates with a greater disparity in intensity values among neighboring voxels. A measure of the randomness/variability in neighborhood intensity value differences. Assesses variations in intensity of			

	1	1	1		
		A measure of heterogeneity that			
		places higher weights on differing			
		intensity level pairs that deviate			
Radiomics	DifferenceVariance	more from the mean.			
		Inverse Difference Normalized is			
		another measure of the local			
		homogeneity of an image. Unlike			
		Homogeneity1, IDN normalizes the			
		difference between the neighboring			
		intensity values by dividing over the			
		total number of discrete intensity			
Radiomics	Idn	values.			
		Inverse Difference Moment is a			
		measure of the local homogeneity			
Radiomics	Idm	of an image.			
		Is a value between 0 (uncorrelated)			
		and 1 (perfectly correlated) showing			
		the linear dependency of gray level			
		values to their respective voxels in			
Radiomics	Correlation	the GLCM.		х	
	1	A measure of the magnitude of the			
Radiomics	Autocorrelation	fineness and coarseness of texture.			
Dedisories	0	A sum of neighborhood intensity			
Radiomics	SumEntropy	value differences.			
		A measure in the distribution of			
		neigboring intensity level pairs about			
		the mean intensity level in the			
Radiomics	SumSquares	GLCM.			
		Cluster Prominence is a measure of			
		the skewness and asymmetry of			
		the GLCM. A higher values implies			
		more asymmetry about the mean			
		while a lower value indicates a peak			
		near the mean value and less			
Radiomics	ClusterProminence	variation about the mean.			
		Informational Measure of			
		Correlation 2 assesses the			
		correlation between the probability			
		distributions of i and j (quantifying			
		the complexity of the texture). The			
		range of IMC2 = [0, 1), with 0			
		representing the case of 2			
		independent distributions (no mutual			
		information) and the maximum			
		value representing the case of 2			
Dediamica	1	fully dependent and uniform			
Radiomics	Imc2	distributions			
		Informational Measure of			
		Correlation 1 assesses the			
		correlation between the probability			
		distributions of i and j (quantifying			
		the complexity of the texture),			
		using mutual information I(x, y). In			
		the case where the distributions are			
		independent, there is no mutual			
		information and the result will			
		therefore be 0. In the case of			
		uniform distribution with complete			
		dependence, mutual information will			
		be equal to log2(Ng). Ng=matrix			
Radiomics	lmc1				
Radiomics	Imc1	size			
		Measures the relationship between			
		occurrences of pairs with similar			
		intensity values and occurrences of			
Radiomics	DifferenceAverage	pairs with differing intensity values.			
	- 3 -	3 1, 1100	1		

			I			1	
		Inverse Difference is a measure of					
		the local homogeneity of an image.					
		With more uniform gray levels, the					
		denominator will remain low,					
Radiomics	Id	resulting in a higher overall value.					
		A measure of groupings of voxels					
Radiomics	ClusterTendency	with similar gray-level values.					
Tadomica	Cluster rendericy						
		P75-P25; P25 and P75 are the 25th					
		and 75th percentile of the image					
Radiomics	InterquartileRange	array, respectively			х		
		Measures the asymmetry of the					
		distribution of values about the					
		Mean value. Depending on where					
		the tail is elongated and the mass					
		of the distribution is concentrated,					
		this value can be positive or					
Radiomics	Skewness	negative.					
		A measure of the sum of the					
		A measure of the sum of the				l	
		squares of each intensity value.					
		This is a measure of the				l	
		homogeneity of the image array,				l	
		where a greater uniformity implies a				l	
						l	
De diamaia a	1 1 - 26 24	greater homogeneity or a smaller				l	
Radiomics	Uniformity	range of discrete intensity values.					
		The median gray level intensity					
Radiomics	Median	within the ROI					
		A measure of the meanitude of					
		A measure of the magnitude of					
		voxel values in an image. A larger					
		values implies a greater sum of the					
Radiomics	Energy	squares of these values					
		The mean distance of all intensity					
		The mean distance of all intensity					
		values from the Mean Value					
		calculated on the subset of image					
		array with gray levels in between, or					
	RobustMeanAbsoluteDe	equal to the 10th and 90th					
Radiomics	viation	percentile					
Tradiornics	VIALION						
		The mean distance of all intensity					
		values from the Mean Value of the					
Radiomics	MeanAbsoluteDeviation	image array					
		The value of Energy feature scaled					
		by the volume of the voxel in cubic					
Radiomics	TotalEnergy	mm			х		
Radiomics	Maximum	Maximum gray level within the ROI					
	Maximulti						
		The square-root of the mean of all				l	
		the squared intensity values. It is				l	
		another measure of the magnitude					
Radiomics	RootMeanSquared	of the image values.				l	
		-					
		90th percentile of gray levels within					
Radiomics	90Percentile	the ROI					L
Radiomics	Minimum	Minimum gray level within the ROI				l	
		1				l	
		Specifies the					
		uncertainty/randomness in the				l	
		image values. It measures the				l	
		average amount of information				l	
	L	-				l	
Radiomics	Entrony	required to encode the image values					
Radiomics	Entropy		-	1			
Radiomics Radiomics	Entropy Range	Range of gray values in the ROI					
		The mean of the squared distances					
		The mean of the squared distances					
		The mean of the squared distances of each intensity value from the					
Radiomics	Range	The mean of the squared distances of each intensity value from the Mean value. This is a measure of the spread of the distribution about					
		The mean of the squared distances of each intensity value from the Mean value. This is a measure of the spread of the distribution about the mean.					
Radiomics	Range	The mean of the squared distances of each intensity value from the Mean value. This is a measure of the spread of the distribution about					

		A measure of the peakedness of			
		the distribution of values in the			
		image ROI. A higher kurtosis			
		implies that the mass of the			
		distribution is concentrated towards			
		the tail(s) rather than towards the			
		mean. A lower kurtosis implies the			
		reverse: that the mass of the			
		distribution is concentrated towards			
Radiomics	Kurtosis	a spike near the Mean value			
		The average gray level intensity			
Radiomics	Mean	within the ROI			
Tadiomics	Wear				
		Measures the joint distribution of			
	-	shorter run lengths with lower gray-			
Radiomics	Emphasis	level values.			
		Measures the distribution of low			
		gray-level values, with a higher			
		value indicating a greater			
	LowGrayLevelRunEmph	concentration of low gray-level			
Radiomics	asis	values in the image.			
		Ŭ Ŭ	 		
1		Management the starting of the			
1		Measures the similarity of gray-level			
1		intensity values in the image, where			
1		a lower GLNN value correlates with			
1		a greater similarity in intensity			
1	GrayLevelNonUniformit	values. This is the normalized			
Radiomics	yNormalized	version of the GLN formula.			
		A measure of the variance in runs			
Radiomics	RunVariance	for the run lengths.		х	
		A measure of the distribution of			
		long run lengths, with a greater			
		value indicative of longer run lengths			
		and more coarse structural			
Radiomics	LongRunEmphasis	textures.			
		Measures the joint distribution of			
	ShortRunHighGrayLevel	shorter run lengths with higher gray-			
Radiomics	Emphasis	level values.			
		Measures the similarity of run			
		lengths throughout the image, with			
		a lower value indicating more			
	RunLengthNonUniformit	homogeneity among run lengths in			
Radiomics	У	the image.			х
		A measure of the distribution of			
		short run lengths, with a greater			
1		value indicative of shorter run			
1		lengths and more fine textural			
Radiomics	ShortRunEmphasis	textures.			
		Measures the joint distribution of			
1					
Padiamias		long run lengths with higher gray-			
Radiomics	Emphasis	level values.			
1		Measures the coarseness of the			
1		texture by taking the ratio of			
1		number of runs and number of			
1		voxels in the ROI. Values are in			
		range Np<=RP<=1, with higher			
		values indicating a larger portion of			1
		values indicating a larger portion of			
		the ROI consists of short runs			
		the ROI consists of short runs (indicates a more fine texture). Np			
		the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the			
Radiomics	RunPercentage	the ROI consists of short runs (indicates a more fine texture). Np			
Radiomics	RunPercentage	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the			
Radiomics	RunPercentage	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image			
Radiomics		the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of			
	LongRunLowGrayLevel	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of long run lengths with lower gray- level values.			
	LongRunLowGrayLevel	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of long run lengths with lower gray- level values. Measures the			
	LongRunLowGrayLevel	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of long run lengths with lower gray- level values. Measures the uncertainty/randomness in the			
	LongRunLowGrayLevel	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of long run lengths with lower gray- level values. Measures the uncertainty/randomness in the distribution of run lengths and gray			
	LongRunLowGrayLevel	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of long run lengths with lower gray- level values. Measures the uncertainty/randomness in the distribution of run lengths and gray levels. A higher value indicates			
	LongRunLowGrayLevel	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of long run lengths with lower gray- level values. Measures the uncertainty/randomness in the distribution of run lengths and gray			
	LongRunLowGrayLevel	the ROI consists of short runs (indicates a more fine texture). Np be the number of voxels in the image Measures the joint distribution of long run lengths with lower gray- level values. Measures the uncertainty/randomness in the distribution of run lengths and gray levels. A higher value indicates			

Addomics         Index gray-work values, with a piper work values in the image. We work on the image work work in the image. We work on the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We work in the image work in the image. We want in the image. We wanthe intere image. We want in the image. We want in the image. We		1				1
Note:         Note: <th< td=""><td></td><td></td><td>Measures the distribution of the</td><td></td><td></td><td></td></th<>			Measures the distribution of the			
hgC org.uo.energy			higher gray-level values, with a			
Backernics         wais         waters in the image. Multiply fram and the integrated yram is and its stratistic throughout his image. Multiply fram integrated yram grane that here is a set of the image. Multiply fram integrated yram grane that here is a set of the image. Multiply fram integrated yram grane that here is a set of the image. Multiply fram integrated yram grane that here is a set of the image. Multiply fram is a set of the image. Mul			higher value indicating a greater			
Measures the instruction of the number of the instruction of the product the instruction of the produ		HighGrayLevelRunEmp	concentration of high gray-level			
Retire to roughout the image, with introgenet a work is bidding in the integration of the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the IAI formula whent IAI formula when IAI formula when the IAI fo	Radiomics	hasis	values in the image.			
Retire to roughout the image, with introgenet a work is bidding in the integration of the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the integration is a second to the IAI formula when the IAI formula whent IAI formula when IAI formula when the IAI fo			Measures the similarity of run			
above water inducting more particity (Note With the Proper This is the constants with the Proper This is the constant with the Proper This is the constants the proper This is the constants the proper This is the constants with the Proper This is the constants the proper This is the constants with the Proper This is the constants the proper This is the constants with the Proper This is the constants the proper This is the constants with the Proper This is the proper the is above the doling more is provided with addition of the proper the is the proper This is the proper the is above the doling more is provided is above the doling more is provided is above the doling more is provided is the Provided is the proper the is above the doling more is provided is the Provided is the Provided is the proper the is the Provided is the Provided is the provided is the Provided is the Provided is the provided is the Provided is the Provided is the provided is the Provided is the Provided is the Provided is the provided is the Provided is the Provided is the Provided is the Provided is the provided is the Provided is the Provided is the Provided is the provided is the Provided is the Provided is the Provided is the provided is the Provided is the Provided is			-			
Background         Intergetion of the SI I formula events of the SI I formula events of the SI I formula events the variance in base sets and constitution of the SI I formula events the variance in base sets events the variance in t						
Radomote when being and the is the is the ormalized in the series of the SA how how is the series of the SA how how is the series of the SA how			-			
Radomics when when a wear of the RLV formula Redomics 2000/arrano exames for the 2006 inceres to a set of the 2006 inceres to a se						
Residencies         ZoreViraince         Measures the variability of size prove values that you had by many with a barry with a barry with a barry more horizonarity among zone soor without in the mage, with a barry with a barry more horizonarity among zone soor without in the mage, with a barry with a barry more horizonarity among zone soor without in the mage, with a barry without in the mage.         Image: Comparison of the source many with a barry without in the mage.           Redonics         SineZoreNoteXinformity more horizonarity in size zone withouts.         Image: Comparison of the difference prove value indicating more to wate indicating more provide that in any with a barry more value indicating of size zone values indicating of size zone value indicating of size zone values indicating of size zone values indicating of size zone value indicating of size zone value indication of mage of the properties in the image of the properties in the image.         X           Readonics <t< td=""><td></td><td>RunLengthNonUniformit</td><td>-</td><td></td><td></td><td></td></t<>		RunLengthNonUniformit	-			
Backonics     Zowekramese     Journee for the zones.     Image with a boar value including the mage with a boar value including with a mage with a mage. With a mage with a	Radiomics	yNormalized	version of the RLN formula.			
Redences         SeaZent/bool/formity         Measures the variability of site zone volume in the maga, with a low values indicating mere brongenety arrong zone site water holds in the intege.         Image: Comparison of the S2M           Redences         SeaZent/bool/formity         memales         Image: Comparison of the S2M           Redences         SeaZent/bool/formity         memales dear zones where comparison in the mage of the piet distribution of uniter or zones and number of uniter or zones where uniter         Image: Comparison in the mage of the piet distribution of uniter or zones where uniter         Image: Comparison in the mage of the piet distribution of uniter or zone with the graphic uniter or zone and number or zone where uniter         Im			Measures the variance in zone size			
space where introgrates       space where intermediates       space where intermediates       space where intermediates       space	Radiomics	ZoneVariance	volumes for the zones.			
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	Measures the proportion in the			
	image of the joint distribution of			
SmallAreaLowGrayLo	eve smaller size zones with lower gray-			
Radiomics IEmphasis	level values.		х	
	A measure of average difference			
	between the center voxel and its			
	neighbourhood and is an indication			
	of the spatial rate of change. A			
	higher value indicates a lower spatial			
	change rate and a locally more			
Radiomics Coarseness	uniform texture.			
	An image is considered complex			
	when there are many primitive			
	components in the image, i.e. the			
	image is non-uniform and there are			
	many rapid changes in gray level			
Radiomics Complexity	intensity.			
	Strength is a measure of the			
	primitives in an image. Its value is			
	high when the primitives are easily			
	defined and visible, i.e. an image			
	with slow change in intensity but			
	more large coarse differences in			
Radiomics Strength	gray level intensities.			
	A measure of the change from a			
	pixel to its neighbour. A high value			
	for busyness indicates a busy			
	image, with rapid changes of			
	intensity between pixels and its			