Model: "encoder"

Layer (type)	Output Shape	Param #
input_layer_4 (InputLayer)	(None, 64, 64, 1)	0
conv2d (Conv2D)	(None, 64, 64, 8)	80
max_pooling2d (MaxPooling2D)	(None, 32, 32, 8)	0
conv2d_1 (Conv2D)	(None, 32, 32, 16)	1,168
max_pooling2d_1 (MaxPooling2D)	(None, 16, 16, 16)	0
conv2d_2 (Conv2D)	(None, 16, 16, 32)	4,640
max_pooling2d_2 (MaxPooling2D)	(None, 8, 8, 32)	0
conv2d_3 (Conv2D)	(None, 8, 8, 64)	18,496
max_pooling2d_3 (MaxPooling2D)	(None, 4, 4, 64)	0
conv2d_4 (Conv2D)	(None, 4, 4, 128)	73,856
max_pooling2d_4 (MaxPooling2D)	(None, 2, 2, 128)	0
conv2d_5 (Conv2D)	(None, 2, 2, 256)	295,168
global_average_pooling2d (GlobalAveragePooling2D)	(None, 256)	0
flatten (Flatten)	(None, 256)	0
dense_16 (Dense)	(None, 16)	4,112

Layer (type)	Output Shape	Param #
input_layer_5 (InputLayer)	(None, 16)	0
dense_17 (Dense)	(None, 1024)	17,408
reshape (Reshape)	(None, 2, 2, 256)	0
conv2d_6 (Conv2D)	(None, 2, 2, 256)	590,080
up_sampling2d (UpSampling2D)	(None, 4, 4, 256)	0
conv2d_7 (Conv2D)	(None, 4, 4, 128)	295,040
up_sampling2d_1 (UpSampling2D)	(None, 8, 8, 128)	0
conv2d_8 (Conv2D)	(None, 8, 8, 64)	73,792
up_sampling2d_2 (UpSampling2D)	(None, 16, 16, 64)	0
conv2d_9 (Conv2D)	(None, 16, 16, 32)	18,464
up_sampling2d_3 (UpSampling2D)	(None, 32, 32, 32)	0
conv2d_10 (Conv2D)	(None, 32, 32, 16)	4,624
up_sampling2d_4 (UpSampling2D)	(None, 64, 64, 16)	0
conv2d_11 (Conv2D)	(None, 64, 64, 8)	1,160
conv2d_12 (Conv2D)	(None, 64, 64, 1)	73

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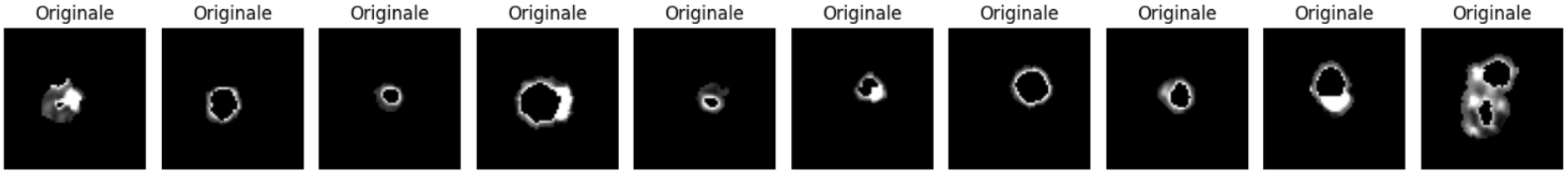
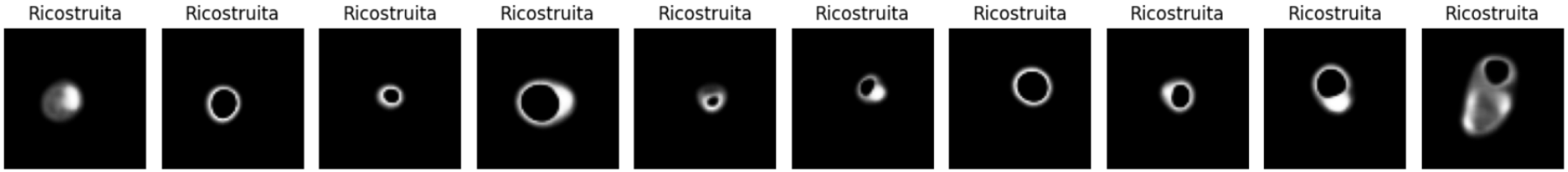
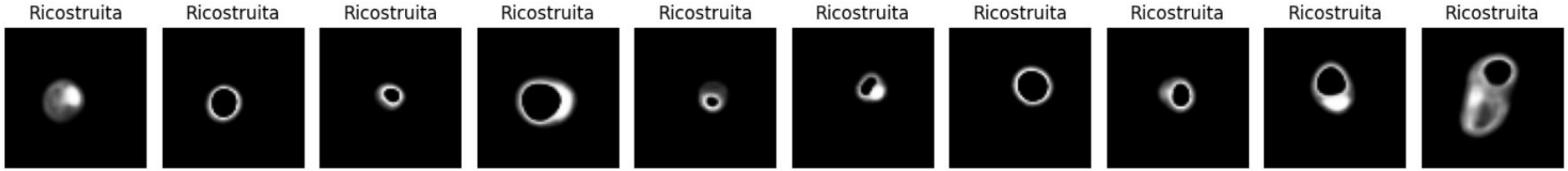


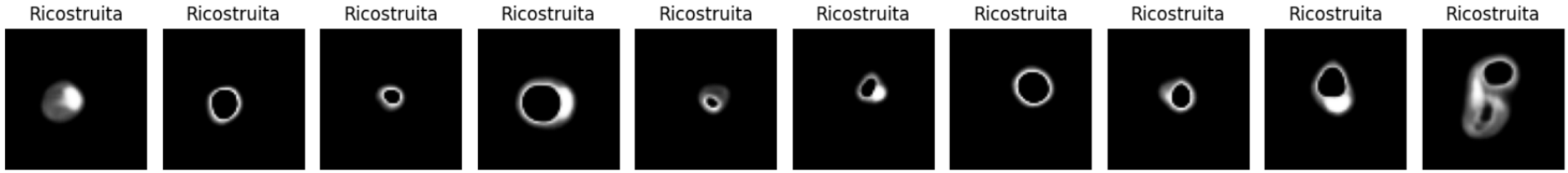
DENSE 16



DENSE 32



DENSE 64



- CLASSIFICATORE VANILLA

Layer (type)	Output Shape	Param #
dense_8 (Dense)	(None, 128)	3,200
batch_normalization_6 (BatchNormalization)	(None, 128)	512
dropout_6 (Dropout)	(None, 128)	0
dense_9 (Dense)	(None, 64)	8,256
batch_normalization_7 (BatchNormalization)	(None, 64)	256
dropout_7 (Dropout)	(None, 64)	0
dense_10 (Dense)	(None, 32)	2,080
batch_normalization_8 (BatchNormalization)	(None, 32)	128
dropout_8 (Dropout)	(None, 32)	0
dense_11 (Dense)	(None, 1)	33

- MLP di sklearn con 3 hidden state (128, 64,32)

Autoencoder	Classificator model	Feature Selector	Precision- recall	Test and val accuracy	Confusion matrix
Vanilla with: 6 convolution 6 maxpooling Dense(64)	mlp = MLPClassifier((128, 64, 32))	RF(32)	Precision VALIDATION: 0.8324 Recall VALIDATION: 0.8313 Precision TEST: 0.8385 Recall TEST: 0.8425	Validation Accuracy: 0.8617 Test Accuracy: 0.8603	Confusion Matrix VALIDATION: [3886 515] [519 2557] Confusion Matrix TEST: [3313 477] [463 2476]
--	--	RF(48)	Precision VALIDATION: 0.8576 Recall VALIDATION: 0.8417 Precision TEST: 0.8790 Recall TEST: 0.8506	Validation Accuracy: 0.8774 Test Accuracy: 0.8836	Confusion Matrix VALIDATION: [3971 430] [487 2589] Confusion Matrix TEST: [3446 344] [439 2500]
	--	MRMR 32	Precision VALIDATION: 0.8455 Recall VALIDATION: 0.8238 Precision TEST: 0.8456 Recall TEST: 0.8220	Validation Accuracy: 0.8656 Test Accuracy: 0.8567	Confusion Matrix VALIDATION: [3938 463] [542 2534] Confusion Matrix TEST: [3349 441] [523 2416]

	--	MRMR 48	Precision VALIDATION: 0.8517 Recall VALIDATION: 0.8309 Precision TEST: 0.8707 Recall TEST: 0.8292	Validation Accuracy: 0.8709 Test Accuracy: 0.8716	Confusion Matrix VALIDATION: [3956 445] [520 2556] Confusion Matrix TEST: [3428 362] [502 2437]
	--	Lasso alpha= 0.0001(34 feature)	Precision VALIDATION: 0.8350 Recall VALIDATION: 0.8322 Precision TEST: 0.8579 Recall TEST: 0.8302	Validation Accuracy: 0.8633 Test Accuracy: 0.8658	Confusion Matrix VALIDATION: [3895 506] [516 2560] Confusion Matrix TEST: [3386 404] [499 2440]
	--	NA	Precision VALIDATION: 0.8678 Recall VALIDATION: 0.8088 Precision TEST: 0.8859 Recall TEST: 0.8163	Validation Accuracy: 0.8707 Test Accuracy: 0.8738	

--	Vanilla with: Dense(128) Batch Droput(0.3) Dense(64) // // Dense(32) // //	RF(32)	Precision Validation: 0.7450 Recall Validation: 0.7350 Precision Test: 0.7657 Recall Test: 0.7428	Validation Accuracy: 0.7875 Test Accuracy: 0.7884	Confusion Matrix VALIDATION: [3627 774] [815 2261] Confusion Matrix TEST: [3122 668] [756 2183]
--	--	RF(48)	Precision Validation: 0.7386 Recall Validation: 0.7341 Precision Test: 0.7580 Recall Test: 0.7332	Validation Accuracy: 0.7837 Test Accuracy: 0.7812	Confusion Matrix VALIDATION: [3602 799] [818 2258] Confusion Matrix TEST: [3102 688] [784 2155]
--	--	MRMR 32	Precision Validation: 0.7464 Recall Validation: 0.7347 Precision Test: 0.7709 Recall Test: 0.7237	Validation Accuracy: 0.7882 Test Accuracy: 0.7854	Confusion Matrix VALIDATION: [3633 768] [816 2260]] Confusion Matrix TEST: [3158 632] [812 2127]
--	--	MRMR 48	Precision Validation: 0.7427 Recall Validation: 0.7168	Validation Accuracy: 0.7813 Test Accuracy: 0.7740	Confusion Matrix VALIDATION: [3637 764] [871 2205]

			Precision Test: 0.7569 Recall Test: 0.7108		Confusion Matrix TEST: [3119 671] [850 2089]
--	--	Lasso alpha= 0.0001(34 feature)	Precision Validation: 0.7530 Recall Validation: 0.7116 Precision Test: 0.7751 Recall Test: 0.7142	Validation Accuracy: 0.7853 Test Accuracy: 0.7847	Confusion Matrix VALIDATION: [3683 718] [887 2189] Confusion Matrix TEST: [3181 609] [840 2099]
--	--	NA	Precision Validation: 0.7416 Recall Validation: 0.7090 Precision Test: 0.7638 Recall Test: 0.7196	Validation Accuracy: 0.7787 Test Accuracy: 0.7804	Confusion Matrix VALIDATION: [3641 760] [895 2181] Confusion Matrix TEST: [3136 654] [824 2115]
Vanilla with: 6	mlp = MLPClassifier((128, 64, 32))	RF (16)	Precision VALIDATION: 0.8393	Validation Accuracy: 0.8576	Confusion Matrix VALIDATION:

convolution 6 maxpooling Dense(32)			Recall VALIDATION: 0.8085 Precision TEST: 0.8555 Recall TEST: 0.8299	Test Accuracy: 0.8645	[3925 476] [589 2487] Confusion Matrix TEST: [3378 412] [500 2439]
--	--	RF(24)	Precision VALIDATION: 0.8050 Recall VALIDATION: 0.8040 Precision TEST: 0.8297 Recall TEST: 0.8074	Validation Accuracy: 0.8391 Test Accuracy: 0.8435	Confusion Matrix VALIDATION: [3801 600] [603 2473] Confusion Matrix TEST: [3303 487] [566 2373]
--	--	MRMR(16 feature MIQ)	Precision VALIDATION: 0.5835 Recall VALIDATION: 0.3726 Precision TEST: 0.6161 Recall TEST: 0.3630	Validation Accuracy: 0.6325 Test Accuracy: 0.6230	Confusion Matrix VALIDATION: [3583 818] [1930 1146] Confusion Matrix TEST: [3125 665] [1872 1067]
--	--	MRMR(24 feature MIQ)	Precision VALIDATION: 0.6384 Recall VALIDATION: 0.5546 Precision TEST:	Validation Accuracy: 0.6876 Test Accuracy: 0.6759	Confusion Matrix VALIDATION: [3435 966] [1370 1706] Confusion Matrix

			0.6539 Recall TEST: 0.5478		TEST: [2938 852] [1329 1610]
--	--	LASSO(0.0001 16 feature)	Precision VALIDATION: 0.8017 Recall VALIDATION: 0.7887 Precision TEST: 0.8123 Recall TEST: 0.7921	Validation Accuracy: 0.8328 Test Accuracy: 0.8292	Confusion Matrix VALIDATION: [3801 600] [650 2426] Confusion Matrix TEST: [3252 538] [611 2328]
--	--	NA	Precision VALIDATION: 0.8325 Recall VALIDATION: 0.8352 Precision TEST: 0.8437 Recall TEST: 0.8377	Validation Accuracy: 0.8630 Test Accuracy: 0.8613	Confusion Matrix VALIDATION: [3884 517] [507 2569] Confusion Matrix TEST: [3334 456] [477 2462]
--	Vanilla with: Dense(128) Batch Droput(0.3) Dense(64) // //	RF (16)	Precision Validation: 0.7358 Recall Validation: 0.7090 Precision Test: 0.7453 Recall Test:	Validation Accuracy: 0.7760 Test Accuracy: 0.7668	Confusion Matrix VALIDATION: [3618 783] [895 2181] Confusion Matrix TEST:

	Dense(32) // //		0.7081		[3079 711] [858 2081]
--	--	RF (24)	Precision Validation: 0.7466 Recall Validation: 0.6869 Precision Test: 0.7585 Recall Test: 0.7033	Validation Accuracy: 0.7753 Test Accuracy: 0.7726	Confusion Matrix VALIDATION: [3684 717] [963 2113] Confusion Matrix TEST: [3132 658] [872 2067]
--	--	MRMR (16 feature MIQ)	Precision Validation: 0.5740 Recall Validation: 0.2659 Precision Test: 0.6138 Recall Test: 0.2606	Validation Accuracy: 0.6168 Test Accuracy: 0.605	Confusion Matrix VALIDATION: [3794 607] [2258 818] Confusion Matrix TEST: [3308 482] [2173 766]
--	--	MRMR (24 feature MIQ)	Precision Validation: 0.6306 Recall Validation: 0.4285 Precision Test: 0.6450 Recall Test: 0.4223	Validation Accuracy: 0.6616 Test Accuracy: 0.6462	Confusion Matrix VALIDATION: [3629 772] [1758 1318] Confusion Matrix TEST: [3107 683] [1698 1241]

	--	LASSO (0.0001 16 feature)	Precision Validation: 0.7080 Recall Validation: 0.6889 Precision Test: 0.7210 Recall Test: 0.6955	Validation Accuracy: 0.7551 Test Accuracy: 0.7494	Confusion Matrix VALIDATION: [3527 874] [957 2119] Confusion Matrix TEST: [2999 791] [895 2044]
	--	NA	Precision Validation: 0.7159 Recall Validation: 0.6866 Precision Test: 0.7258 Recall Test: 0.6907	Validation Accuracy: 0.7590 Test Accuracy: 0.7509	Confusion Matrix VALIDATION: [3563 838] [964 2112] Confusion Matrix TEST: [3023 767] [909 2030]
	--				
Vanilla with: 6 convolution 6 maxpooling Dense(16)	mlp = MLPClassifier((128, 64, 32))	RF(8)	Precision VALIDATION: 0.7644 Recall VALIDATION: 0.7181 Precision TEST: 0.7808 Recall TEST: 0.7128	Validation Accuracy: 0.7930 Test Accuracy: 0.7872	Confusion Matrix VALIDATION: [3720 681] [867 2209] Confusion Matrix TEST: [3202 588] [844 2095]
--	--	RF(12)	Precision VALIDATION: 0.8091	Validation Accuracy: 0.8295	Confusion Matrix VALIDATION:

			Recall VALIDATION: 0.7663 Precision TEST: 0.8156 Recall TEST: 0.7782	Test Accuracy: 0.8263	[3845 556] [719 2357] Confusion Matrix TEST: [3273 517] [652 2287]
	--	MRMR 8	Precision VALIDATION: 0.5858 Recall VALIDATION: 0.2874 Precision TEST: 0.6048 Recall TEST: 0.2719	Validation Accuracy: 0.6232 Test Accuracy: 0.6044	Confusion Matrix VALIDATION: [3776 625] [2192 884] Confusion Matrix TEST: [3268 522] [2140 799]
	--	MRMR 12	Precision VALIDATION: 0.6310 Recall VALIDATION: 0.5176 Precision TEST: 0.6565 Recall TEST: 0.5053	Validation Accuracy: 0.6770 Test Accuracy: 0.6684	Confusion Matrix VALIDATION: [3470 931] [1484 1592] Confusion Matrix TEST: [3013 777] [1454 1485]
	--	Lasso alpha= 0.0001(9 feature)	Precision VALIDATION: 0.8143 Recall VALIDATION: 0.7942 Precision TEST:	Validation Accuracy: 0.8408 Test Accuracy: 0.8419	Confusion Matrix VALIDATION: [3844 557] [633 2443] Confusion Matrix TEST:

			0.8319 Recall TEST: 0.7996		[3315 475] [589 2350]
	--	NA	Precision VALIDATION: 0.7996 Recall VALIDATION: 0.8378 Precision TEST: 0.8263 Recall TEST: 0.8336	Validation Accuracy: 0.8469 Test Accuracy: 0.8508	Confusion Matrix VALIDATION: [3755 646] [499 2577] Confusion Matrix TEST: [3275 515] [489 2450]
--	Vanilla with: Dense(128) Batch Droput(0.3) Dense(64) // // Dense(32) // //	RF(8)	Precision Validation: 0.6493 Recall Validation: 0.5988 Precision Test: 0.6752 Recall Test: 0.5948	Validation Accuracy: 0.7019 Test Accuracy: 0.6980	Confusion Matrix VALIDATION: [3406 995] [1234 1842] Confusion Matrix TEST: [2949 841] [1191 1748]
--	--	RF(12)	Precision Validation: 0.7292 Recall Validation: 0.6769 Precision Test:	Validation Accuracy: 0.7637 Test Accuracy: 0.76014	Confusion Matrix VALIDATION: [3628 773] [994 2082] Confusion Matrix TEST:

			0.7510 Recall Test: 0.6744		[3133 657] [957 1982]
--	--	MRMR 8	Precision Validation: 0.6351 Recall Validation: 0.1834 Precision Test: 0.6414 Recall Test: 0.1643	Validation Accuracy: 0.6207 Test Accuracy: 0.5949	Confusion Matrix VALIDATION:[4077 324] [2512 564] Confusion Matrix TEST: [3520 270] [2456 483]
--	--	MRMR 12	Precision Validation: 0.6144 Recall Validation: 0.3414 Precision Test: 0.6274 Recall Test: 0.3226	Validation Accuracy: 0.6409 Test Accuracy: 0.6204	Confusion Matrix VALIDATION: [3742 659] [2026 1050] Confusion Matrix TEST: [3227 563] [1991 948]
--	--	Lasso alpha= 0.0001(9 feature)	Precision Validation: 0.7189 Recall Validation: 0.6817 Precision Test: 0.7465 Recall Test: 0.6774	Validation Accuracy: 0.7594 Test Accuracy: 0.7587	Confusion Matrix VALIDATION: [3581 820] [979 2097] Confusion Matrix TEST: [3114 676] [948 1991]

--	--	NA	Precision Validation: 0.7127 Recall Validation: 0.6934 Precision Test: 0.7313 Recall Test: 0.6890	Validation Accuracy: 0.7589 Test Accuracy: 0.7536	Confusion Matrix VALIDATION: [3541 860] [943 2133] Confusion Matrix TEST: [3046 744] [914 2025]

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DENSE 64	DENSE 32	DENSE 16
MLP RF(48): Test Accuracy: 0.8836 Precision TEST: 0.8790 Recall TEST: 0.8506 [3446 344] [439 2500]	MLP RF(16): Test Accuracy: 0.8645 Precision TEST: 0.8555 Recall TEST: 0.8299 [3378 412] [500 2439]	MLP NA: Test Accuracy: 0.8508 Precision TEST: 0.8263 Recall TEST: 0.8336 [3275 515] [489 2450]
VANILLA RF(32): Test Accuracy: 0.7884 Precision Test: 0.7657 Recall Test: 0.7428 [3122 668] [756 2183]	VANILLA RF(32): Test Accuracy: 0.7726 Precision Test: 0.7453 Recall Test: 0.7081 [3079 711] [858 2081]	VANILLA RF(12): Test Accuracy: 0.7601 Precision Test: 0.7510 Recall Test: 0.6744 [3133 657] [957 1982]