PRESENTAZIONE 2/10
CLASSIFICAZIONE 2D e 2.5D
Deep e Radiomica

Number of train patients: 63
Number of test patients: 39
Number of val patients: 27

Data preparation: correlation (0.8) e p_value (0.01)
Risultati sul test riallenando il classificatore con anche il validation

CLASSIFICAZIONE 2D

1) con encoder Rete pretrainata:
    a) VGG19
    b) Resnet 50
    c) InceptionV3

La rete estrae la feature map della slice con area maggiore per ogni placca

2) RADIOMICA
    a) 102 features
    b) Wavelet 474 features

3) Deep + Radiomica
    a) VGG + Radiomica Wavelet
    b) Resnet + Radiomica Wavelet
    c) Inception + Radiomica Wavelet

tabella risultati classificazione 2D

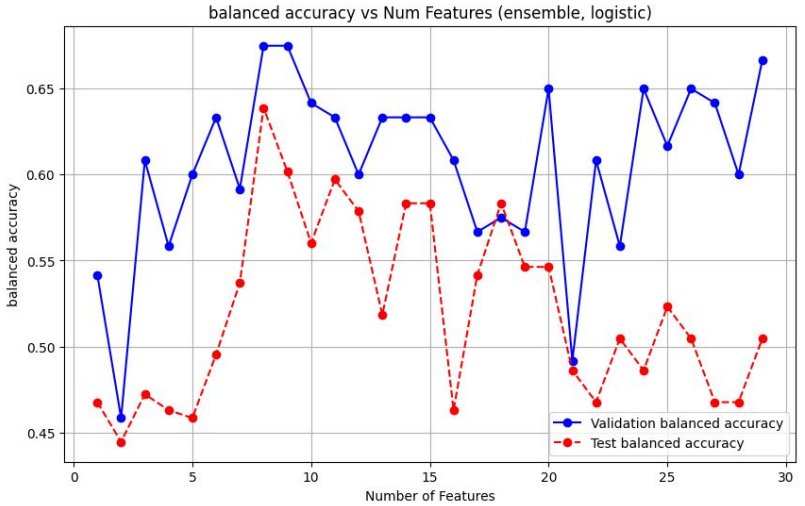
type of features	Classifier	Selector	number features	roc auc val	bal accuracy val	f1 val	roc auc test	bal accuracy test	f1 test	confusion matrix test
RADIOMICA	ensemble	Logistic	8	0.7889	0.6750	0.5556	0.6852	0.6389	0.5000	[[21 6] [6 6]]
Radiomica Wavelet	XgBoost	lasso	31	0.7889	0.7667	0.7273	0.7099	0.6898	0.5806	[[17 10] [3 9]]
VGG19	SVM	rf	12	0.7222	0.7667	0.7273	0.6821	0.7454	0.6429	[[20 7] [3 9]]
Resnet50	RandomFrest	mrmr	2	0.6583	0.7083	0.6923	0.7423	0.6759	0.5714	[[14 13] [2 10]]
InceptionV3	MLP	mrmr	16	0.8278	0.7750	0.7500	0.6481	0.6296	0.5161	[[[16 11] [4 8]]

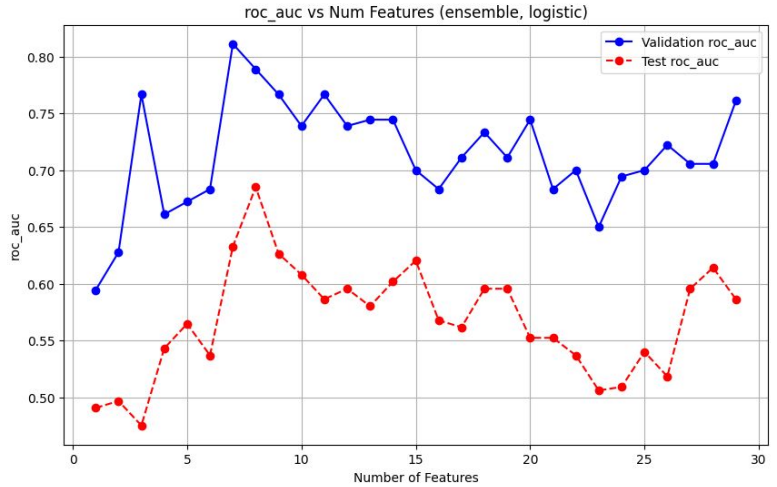
radiomica 2d

Classifier: ensemble
Selector: logistic
Num Features: 8

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.6750
ROC AUC (Validation): 0.7889
F1 Score (Validation): 0.5556
Accuracy (Validation): 0.7037
Confusion Matrix (Validation):
[[14 1]
 [7 5]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.6389
ROC AUC (Test): 0.6852
F1 Score (Test): 0.5000
Accuracy (Test): 0.6923
Confusion Matrix (Test):
[[21 6]
 [6 6]]



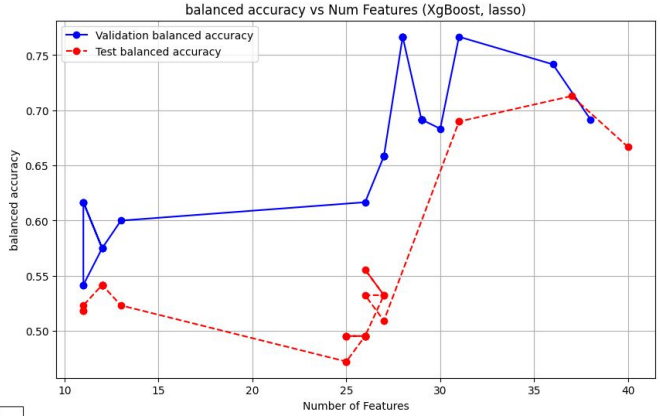


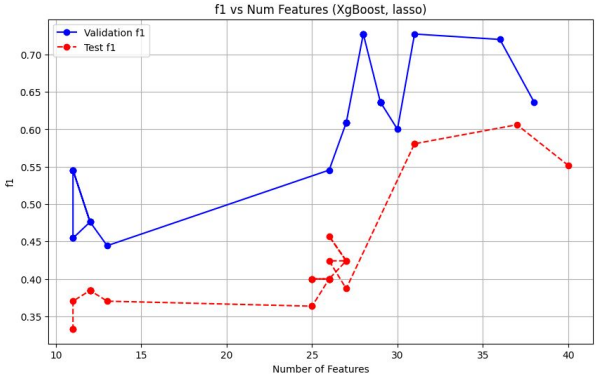
radiomica 2d wavelet

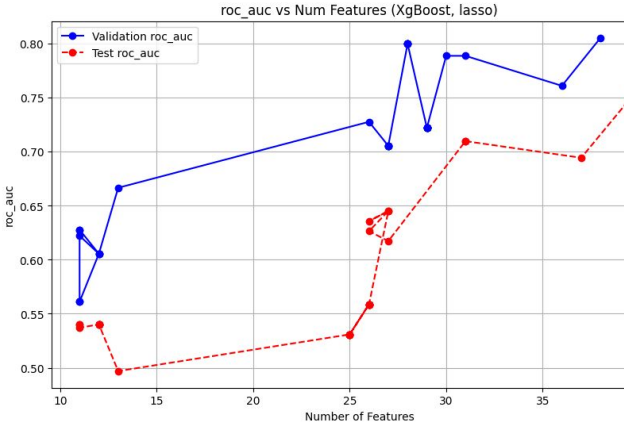
Classifier: XgBoost
Selector: lasso
Alpha: 0.003
Num Features: 31

--- Validation Set Metrics
Balanced Accuracy (Validation): 0.7667
ROC AUC (Validation): 0.7889
F1 Score (Validation): 0.7273
Accuracy (Validation): 0.7778
Confusion Matrix (Validation):
[[13 2]
 [4 8]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.6898
ROC AUC (Test): 0.7099
F1 Score (Test): 0.5806
Accuracy (Test): 0.6667
Confusion Matrix (Test):
[[17 10]
 [3 9]]





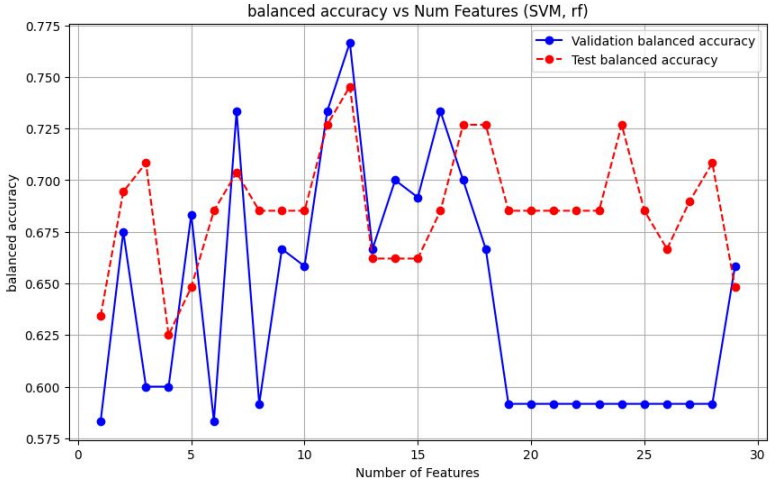


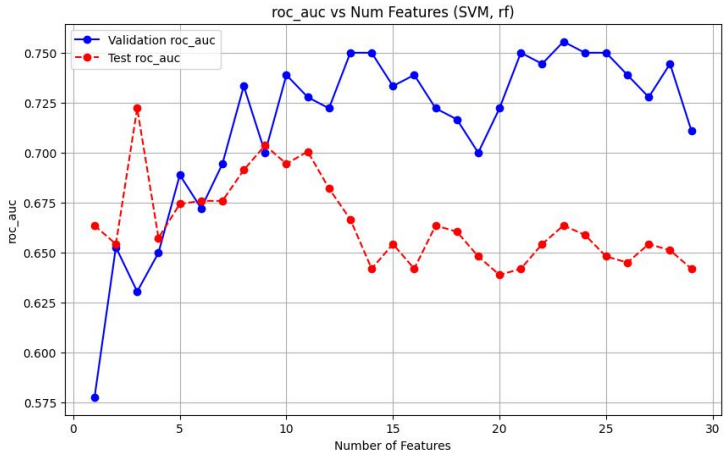
VGG 19 2D

Classifier: SVM
Selector: rf
Num Features: 12

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.7667
ROC AUC (Validation): 0.7222
F1 Score (Validation): 0.7273
Accuracy (Validation): 0.7778
Confusion Matrix (Validation):
[[13 2]
 [4 8]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.7454
ROC AUC (Test): 0.6821
F1 Score (Test): 0.6429
Accuracy (Test): 0.7436
Confusion Matrix (Test):
[[20 7]
 [3 9]]



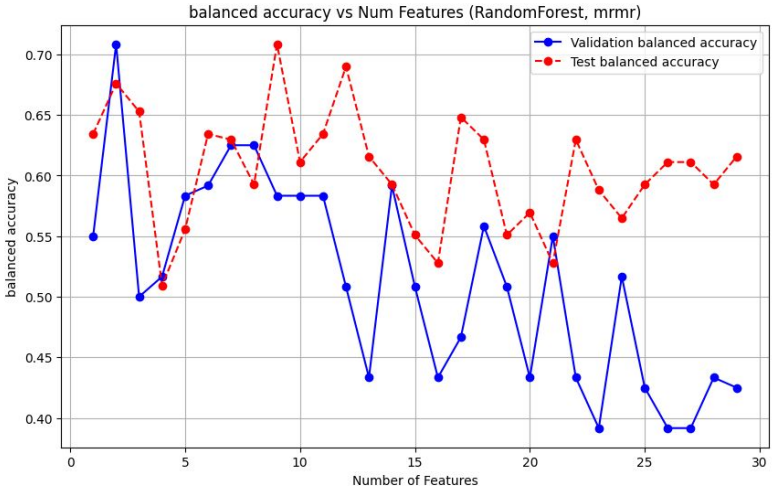


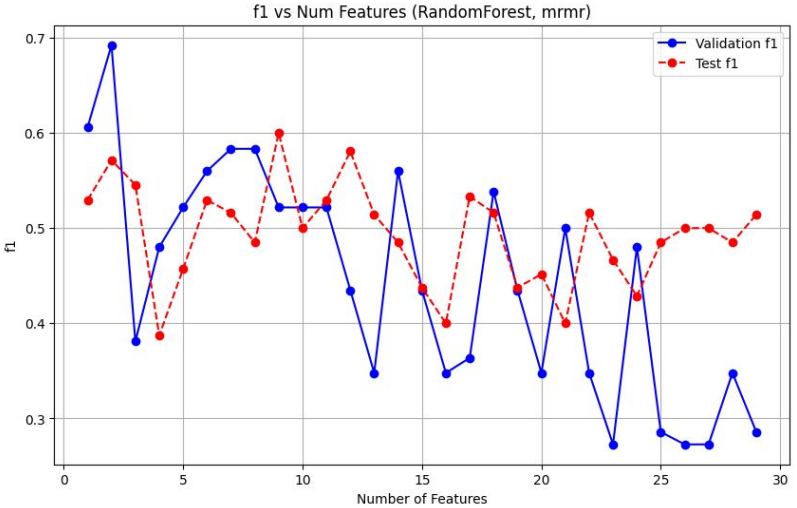
Resnet 50 2D

Classifier: RandomForest
Selector: mrmr
Num Features: 2

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.7083
ROC AUC (Validation): 0.6583
F1 Score (Validation): 0.6923
Accuracy (Validation): 0.7037
Confusion Matrix (Validation):
[[10 5]
[3 9]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.6759
ROC AUC (Test): 0.7423
F1 Score (Test): 0.5714
Accuracy (Test): 0.6154
Confusion Matrix (Test):
[[14 13]
[2 10]]



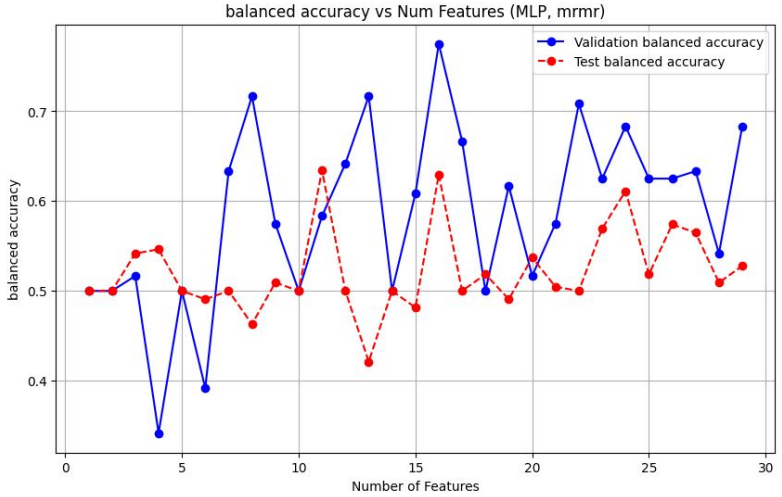


InceptionV3 2D

Classifier: MLP
Selector: mrmr
Num Features: 16

--- Validation Set Metrics---
Balanced Accuracy (Validation): 0.7750
ROC AUC (Validation): 0.8278
F1 Score (Validation): 0.7500
Accuracy (Validation): 0.7778
Confusion Matrix (Validation):
[[12 3]
 [3 9]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.6296
ROC AUC (Test): 0.6481
F1 Score (Test): 0.5161
Accuracy (Test): 0.6154
Confusion Matrix (Test):
[[16 11]
 [4 8]]



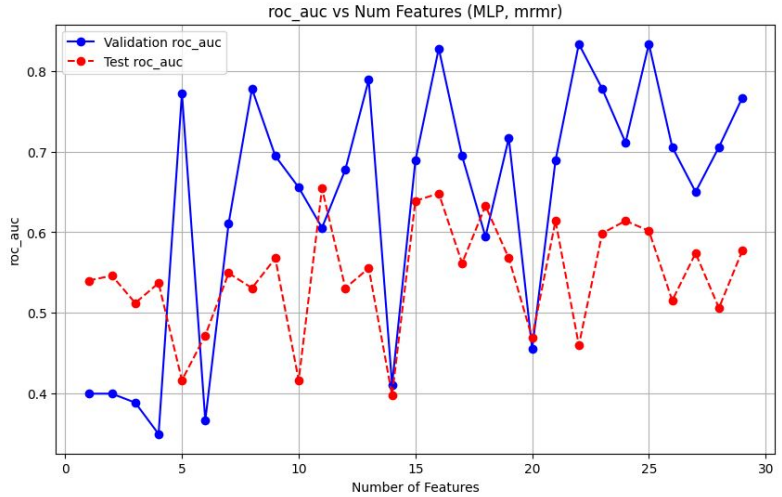


tabella risultati classificazione 2D

Deep + Radiomica Wavelet

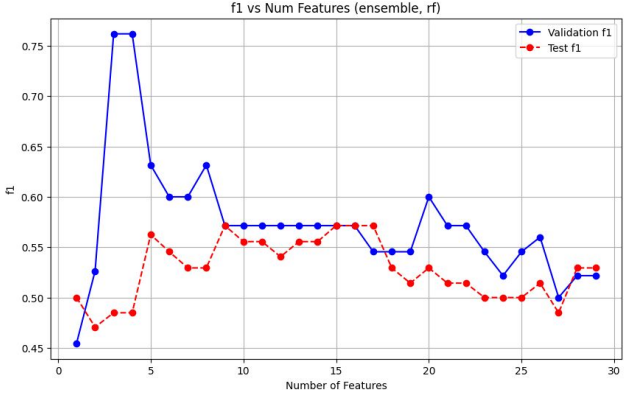
type of features	Classifier	Selector	number features	roc auc val	bal accuracy val	f1 val	roc auc test	bal accuracy test	f1 test	confusion matrix test
VGG19	ensemble	rf	3	0.8444	0.8	0.7619	0.6605	0.5926	0.4848	[[14 13] [4 8]]
Resnet50	RandomForest	rf	9	0.75	0.825	0.8148	0.6343	0.6111	0.5	[[15 12] [4 8]]
InceptionV3	SVM	rf	4	0.7	0.7333	0.6957	0.8025	0.6343	0.5294	[[[14 13] [3 9]]

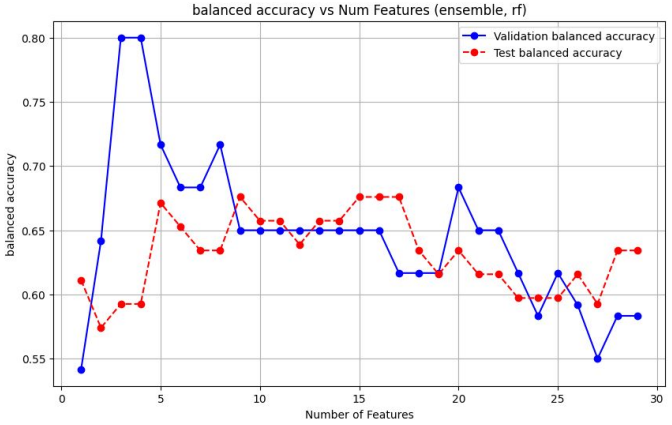
2D Rad + VGG

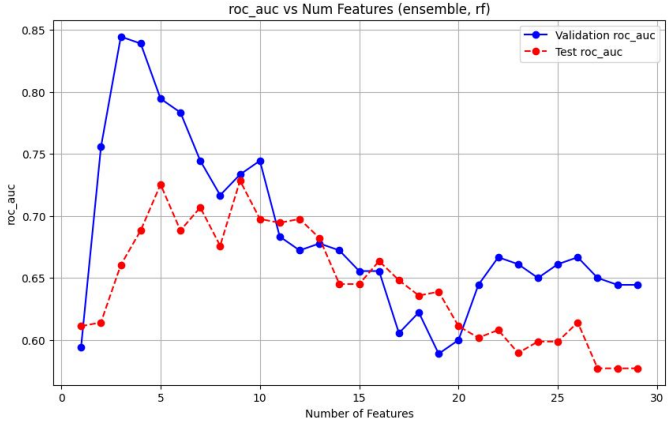
Classifier: ensemble
Selector: rf
Num Features: 3

--- Validation Set Metrics
Balanced Accuracy (Validation): 0.8000
ROC AUC (Validation): 0.8444
F1 Score (Validation): 0.7619
Accuracy (Validation): 0.8148
Confusion Matrix (Validation):
[[14 1]
 [4 8]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.5926
ROC AUC (Test): 0.6605
F1 Score (Test): 0.4848
Accuracy (Test): 0.5641
Confusion Matrix (Test):
[[14 13]
 [4 8]]





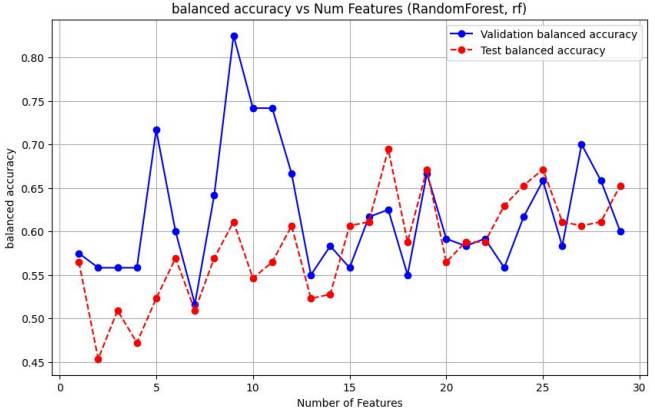


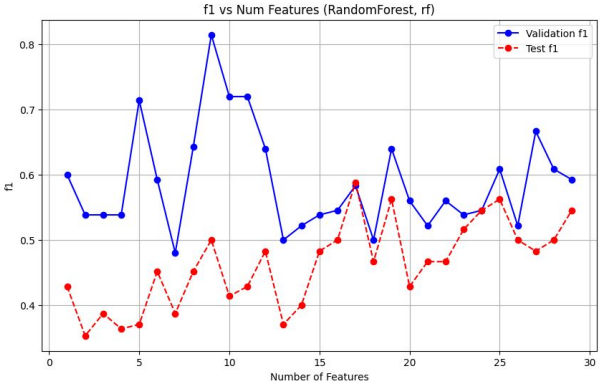
2d rad + resnet

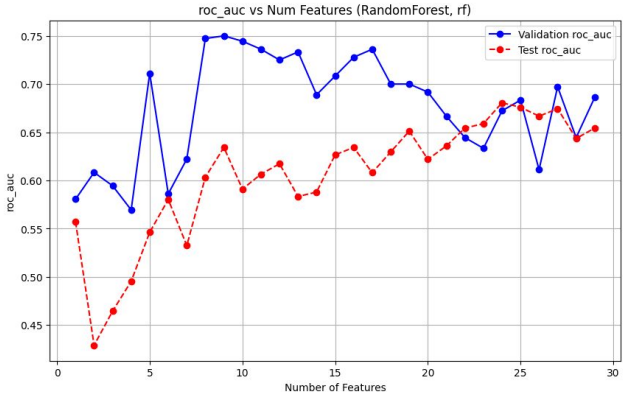
Classifier: RandomForest
Selector: rf
Num Features: 9

--- Validation Set Metrics
Balanced Accuracy (Validation): 0.8250
ROC AUC (Validation): 0.7500
F1 Score (Validation): 0.8148
Accuracy (Validation): 0.8148
Confusion Matrix (Validation):
[[11 4]
 [1 11]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.6111
ROC AUC (Test): 0.6343
F1 Score (Test): 0.5000
Accuracy (Test): 0.5897
Confusion Matrix (Test):
[[15 12]
 [4 8]]





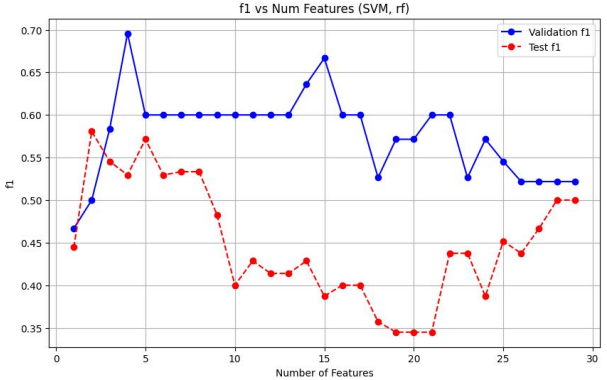


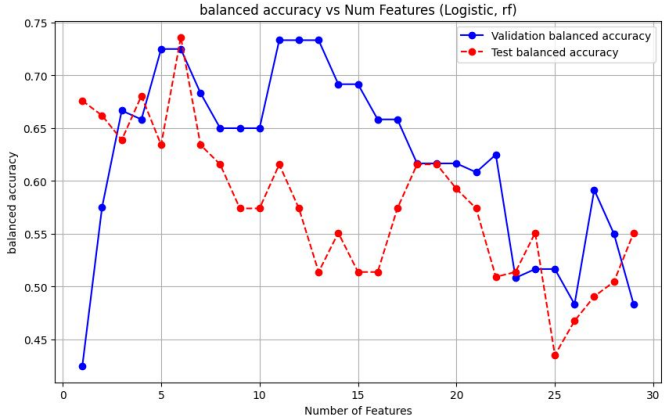
2d Rad + Inc

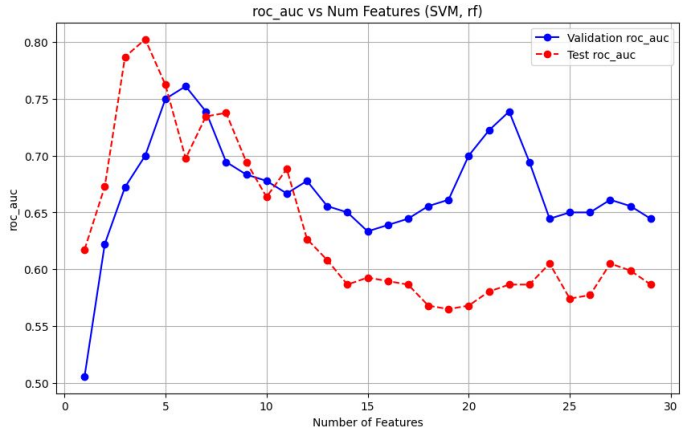
Classifier: SVM
Selector: rf
Num Features: 4

--- Validation Set Metrics
Balanced Accuracy (Validation): 0.7333
ROC AUC (Validation): 0.7000
F1 Score (Validation): 0.6957
Accuracy (Validation): 0.7407
Confusion Matrix (Validation):
[[12 3]
 [4 8]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.6343
ROC AUC (Test): 0.8025
F1 Score (Test): 0.5294
Accuracy (Test): 0.5897
Confusion Matrix (Test):
[[14 13]
 [3 9]]







CLASSIFICAZIONE 2.5D

1) con encoder Rete pretrainata:
    a) VGG19
    b) Resnet 50
    c) InceptionV3

La rete estrae la feature map da tutte le slice poi applica MV/ Mean per ottenere la predizione finale per la placca

2) RADIOMICA
    a) 102 features
    b) Wavelet 474 features

3) Deep + Radiomica
    a) Resnet + Radiomica Wavelet
    b) Inception + Radiomica Wavelet

tabella risultati classificazione 2.5D

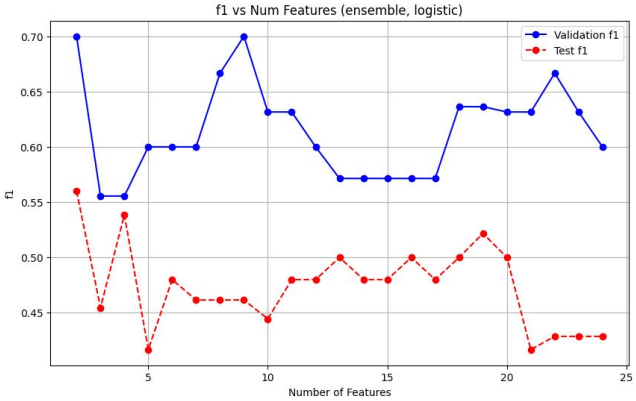
type of features	Classifier	Selector	features	Mode	roc auc val	bal accuracy val	f1 val	roc auc test	bal accuracy test	f1 test	confusion matrix test
RADIOMICA	ensemble	logistic	2	Mean	0.7889	0.7583	0.7	0.6944	0.6806	0.56	[[21 6] [5 7]]
RADIOMICA wavelet	Logistic	mrmr	23	Mean	0.85	0.8	0.7619	0.7747	0.7456	0.6429	[[20 7] [3 9]]
VGG19	Random Forest	logistic	23	MV	0.5556	0.6333	0.6154	0.6235	0.6019	0.4615	[[19 8] [6 6]]
Resnet50	Logistic	rf	28	MV	0.6333	0.7	0.6667	0.8302	0.7361	0.6364	[[24 3] [5 7]]
InceptionV3	SVM	logistic	12	mean	0.5444	0.6583	0.6087	0.6914	0.7407	0.64	[[22 5] [4 8]]

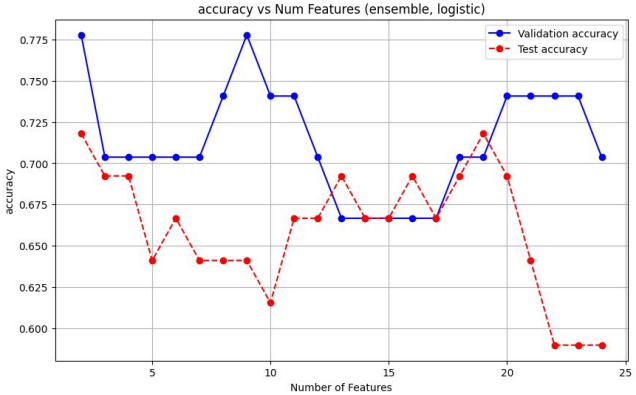
Radiomica 2.5 D

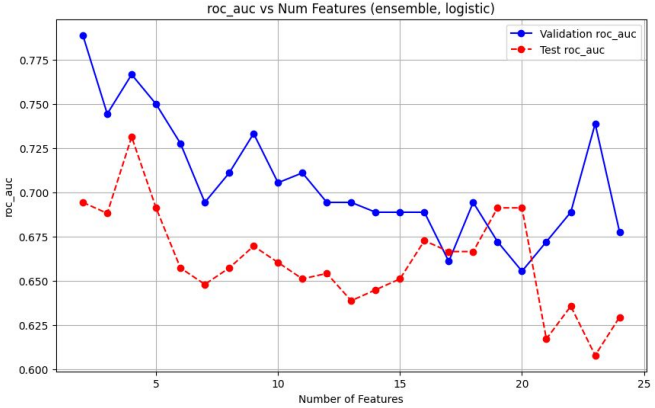
Classifier: ensemble
Selector: logistic
Mode: Mean
Num Features: 2

--- Validation Set Metrics —
Balanced Accuracy (Validation): 0.7583
ROC AUC (Validation): 0.7889
F1 Score (Validation): 0.7000
Accuracy (Validation): 0.7778
Confusion Matrix (Validation):
[[14 1]
 [5 7]]

--- Corresponding Test Set Metrics —
Balanced Accuracy (Test): 0.6806
ROC AUC (Test): 0.6944
F1 Score (Test): 0.5600
Accuracy (Test): 0.7179
Confusion Matrix (Test):
[[21 6]
 [5 7]]





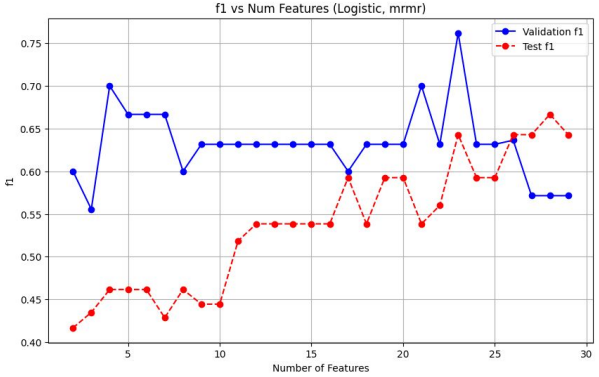


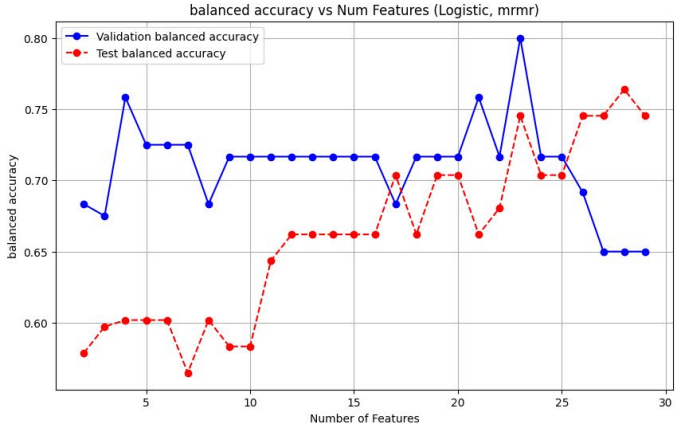
radiomica Wavelet 2.5 D

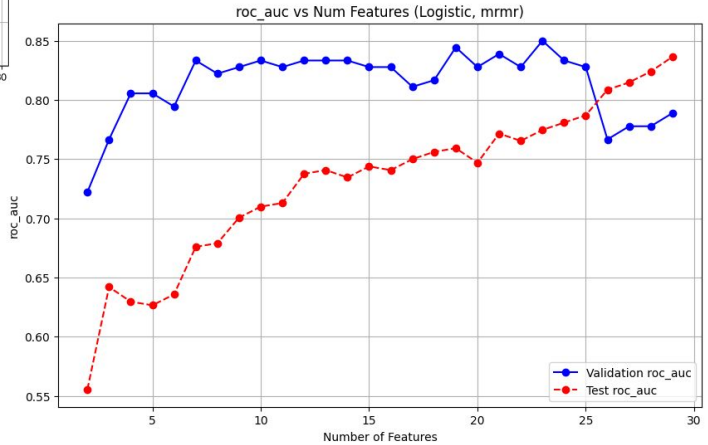
Classifier: Logistic
Selector: mrmr
Mode: Mean
Num Features: 23

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.8000
ROC AUC (Validation): 0.8500
F1 Score (Validation): 0.7619
Accuracy (Validation): 0.8148
Confusion Matrix (Validation):
[[14 1]
 [4 8]]

--- Corresponding Test Set Metrics ---
Balanced Accuracy (Test): 0.7454
ROC AUC (Test): 0.7747
F1 Score (Test): 0.6429
Accuracy (Test): 0.7436
Confusion Matrix (Test):
[[20 7]
 [3 9]]





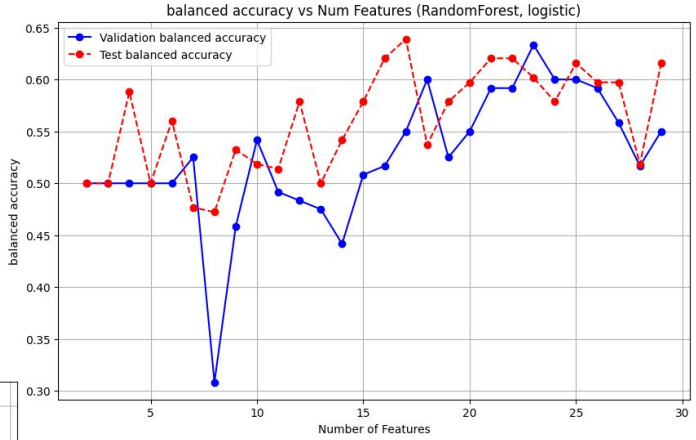


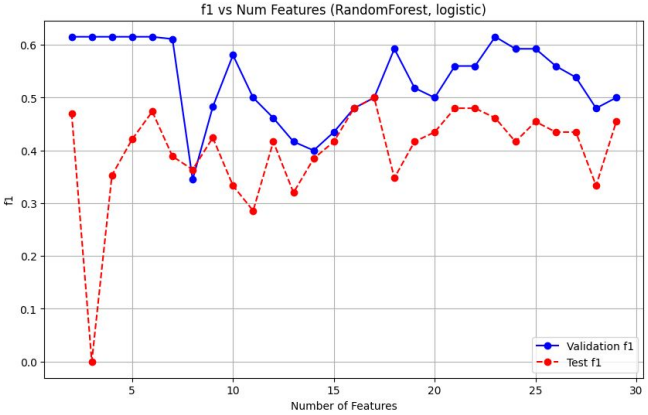
VGG 19 2.5D

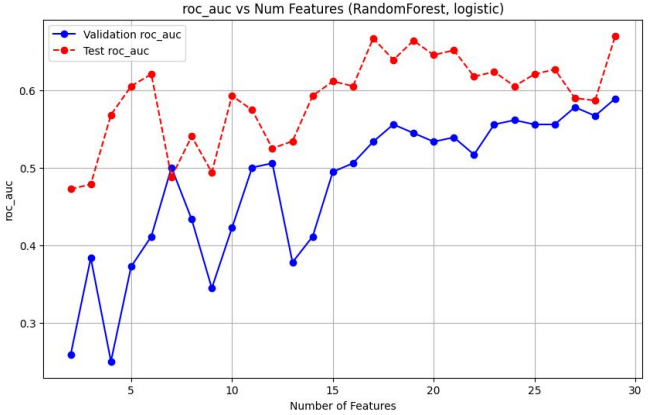
Classifier: RandomForest
Selector: logistic
Mode: MV
Num Features: 23

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.633
ROC AUC (Validation): 0.5556
F1 Score (Validation): 0.6154
Accuracy (Validation): 0.6296
Confusion Matrix (Validation):
[[9 6]
 [4 8]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.6019
ROC AUC (Test): 0.6235
F1 Score (Test): 0.4615
Accuracy (Test): 0.6410
Confusion Matrix (Test):
[[19 8]
 [6 6]]
==========





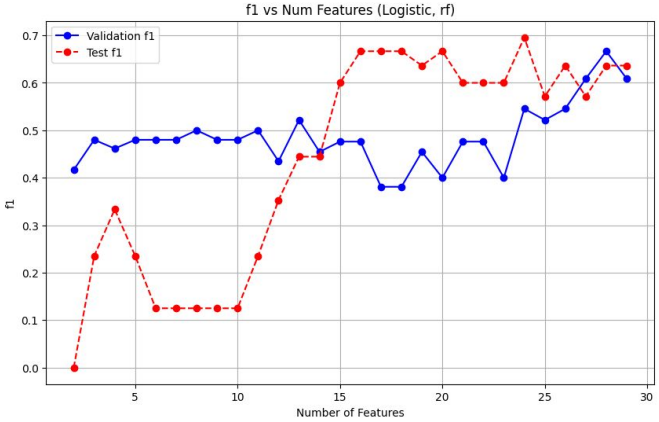


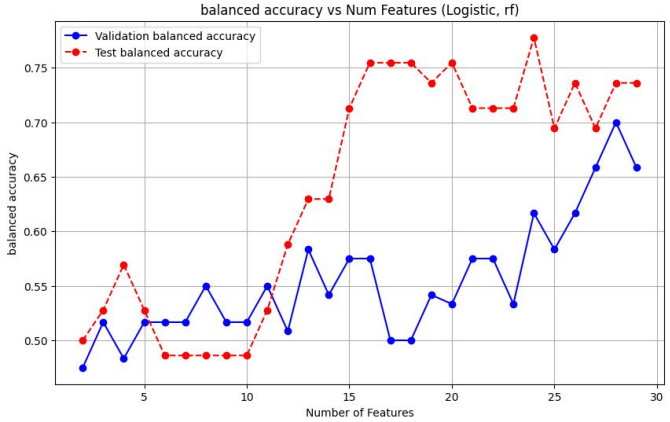
Resnet 2.5 D

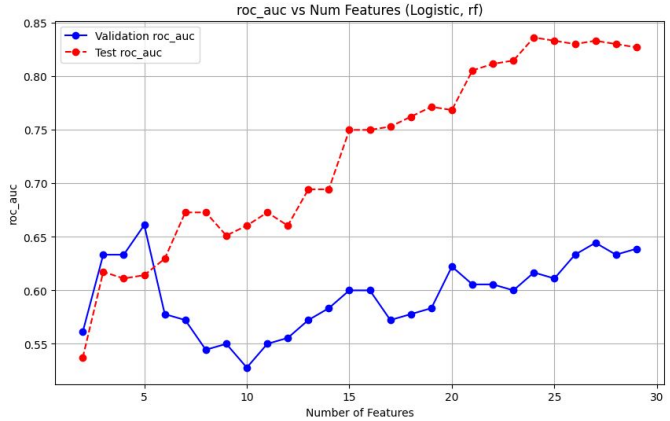
Classifier: Logistic
Selector: rf
Mode: MV
Num Features: 28

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.7
ROC AUC (Validation): 0.6333
F1 Score (Validation): 0.6667
Accuracy (Validation): 0.7037
Confusion Matrix (Validation):
[[11 4]
 [4 8]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.7361
ROC AUC (Test): 0.8302
F1 Score (Test): 0.6364
Accuracy (Test): 0.7949
Confusion Matrix (Test):
[[24 3]
 [5 7]]





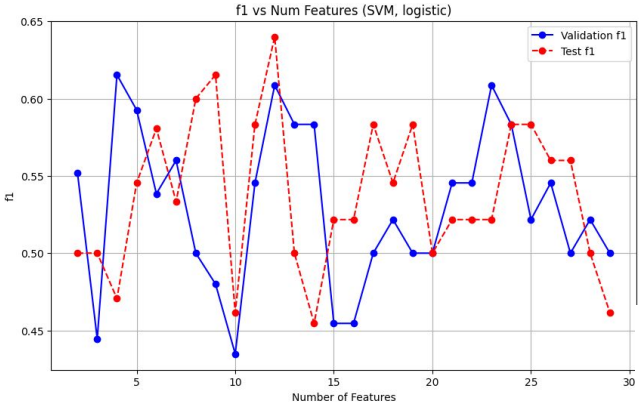


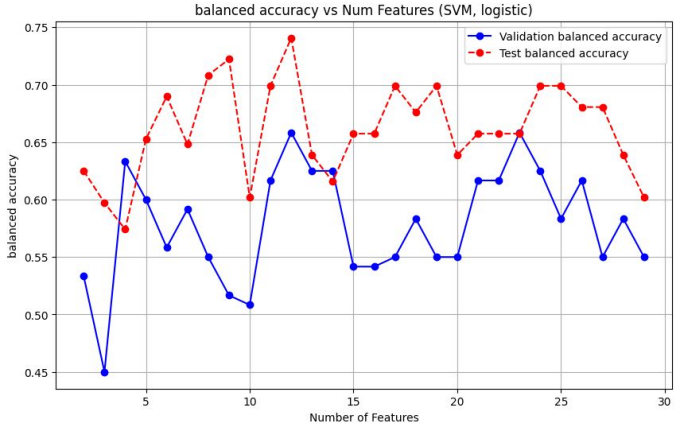
Inception 2.5 D

Classifier: SVM
Selector: logistic
Mode: Mean
Num Features: 12

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.658
ROC AUC (Validation): 0.5444
F1 Score (Validation): 0.6087
Accuracy (Validation): 0.6667
Confusion Matrix (Validation):
[[11 4]
 [5 7]]

--- Corresponding Test Result ---
Balanced Accuracy (Test): 0.7407
ROC AUC (Test): 0.6914
F1 Score (Test): 0.6400
Accuracy (Test): 0.7692
Confusion Matrix (Test):
[[22 5]
 [4 8]]





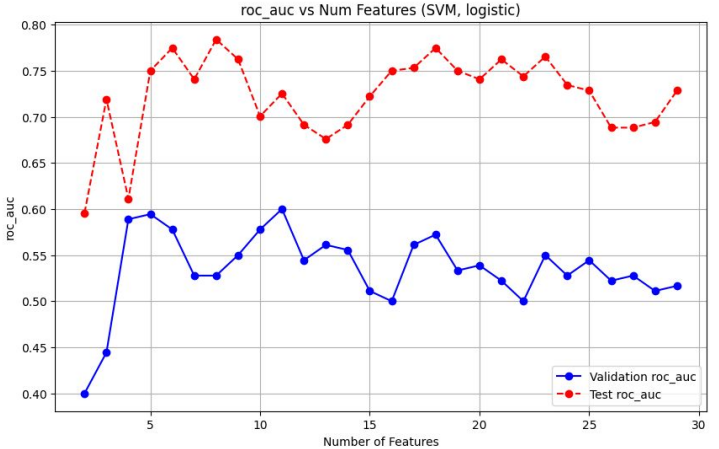


Tabella risultati classificazione 2.5D Deep + Radiomica Wavelet

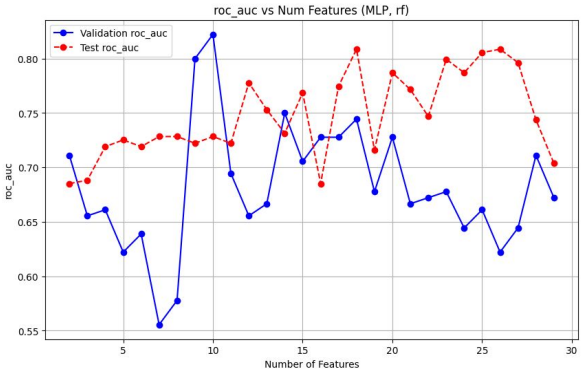
type of features	Classifier	Selector	features	mode	roc auc val	bal accuracy val	f1 val	roc auc test	bal accuracy test	f1 test	confusion matrix test
Wavelet + Inception	MLP	rf	22	MV	0.6722	0.7667	0.7273	0.6722	0.7222	0.6154	[[21 6] [4 8]]
Wavelet + Resnet	Random Forest	mrmr	5	Mean	0.772	0.7583	0.7	0.713	0.7361	0.6364	[[24 3] [5 7]]

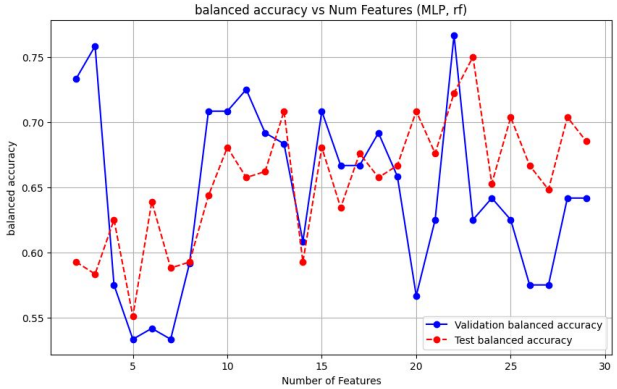
Radiomica Wavelet + Inception

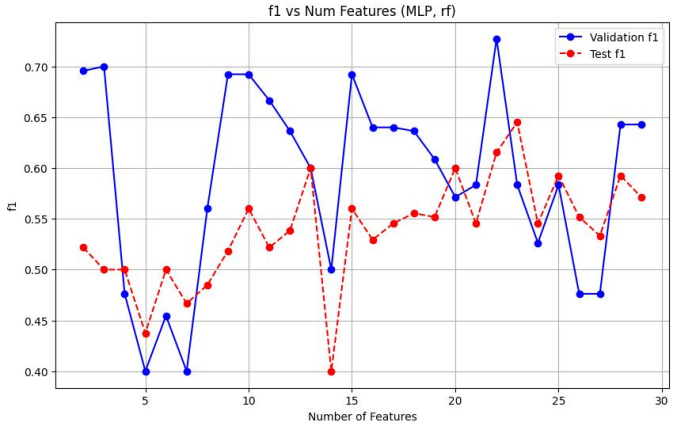
Classifier: MLP
Selector: rf
Mode: MV
Num Features: 22

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.7667
ROC AUC (Validation): 0.6722
F1 Score (Validation): 0.7273
Accuracy (Validation): 0.7778
Confusion Matrix (Validation):
[[13 2]
 [4 8]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.7222
ROC AUC (Test): 0.7469
F1 Score (Test): 0.6154
Accuracy (Test): 0.7436
Confusion Matrix (Test):
[[21 6]
 [4 8]]





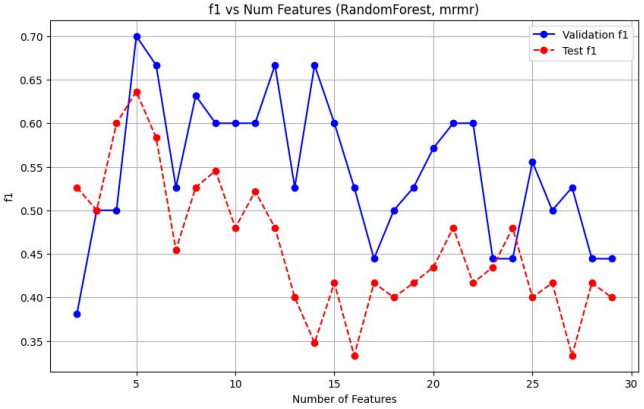


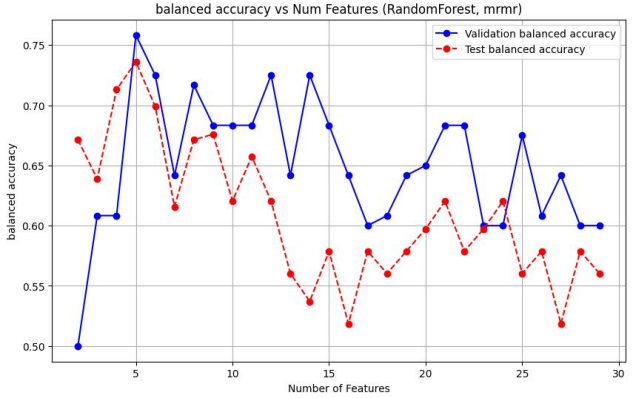
Radiomica Wavelet + Resnet

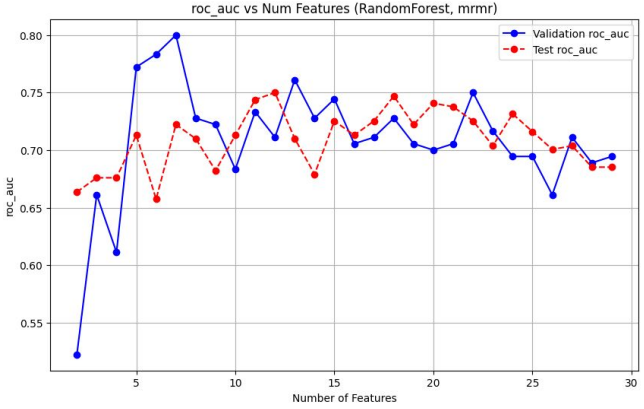
Classifier: RandomForest
Selector: mrmr
Mode: Mean
Num Features: 5

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.7583
ROC AUC (Validation): 0.7722
F1 Score (Validation): 0.7000
Accuracy (Validation): 0.7778
Confusion Matrix (Validation):
[[14 1]
 [5 7]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.7361
ROC AUC (Test): 0.7130
F1 Score (Test): 0.6364
Accuracy (Test): 0.7949
Confusion Matrix (Test):
[[24 3]
 [5 7]]







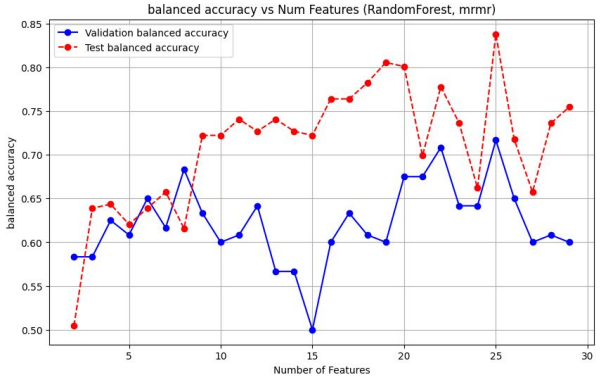
osservazioni

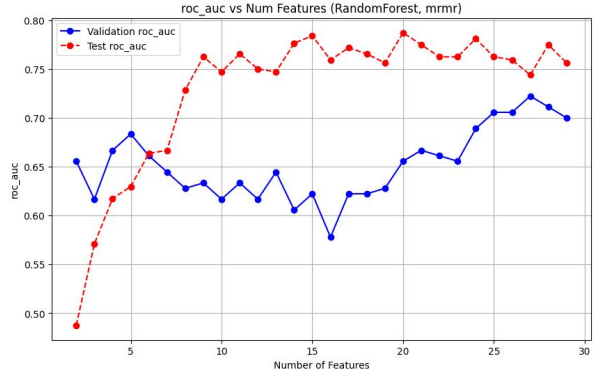
1) Ci sono casi in cui, tra i vari numeri di num_features migliori che trova il validation tenendo fisso classifier e selector, ottengo delle metriche molto buone per il test, che però non sono le migliori globali per il validation.

Features: Radiomica 2.5D Wavelet
Classifier: RandomForest
Selector: mrmr
Mode: MV
Num Features: 25

--- Validation Set Metrics ---
Balanced Accuracy (Validation): 0.7167
ROC AUC (Validation): 0.7056
F1 Score (Validation): 0.6316
Accuracy (Validation): 0.7407
Confusion Matrix (Validation):
[[14 1]
[6 6]]

--- Test Set Metrics ---
Balanced Accuracy (Test): 0.8380
ROC AUC (Test): 0.7623
F1 Score (Test): 0.7826
Accuracy (Test): 0.8718
Confusion Matrix (Test):
[[25 2]
[3 9]]





2) Variando il seed otteniamo dei casi migliori rispetto al tenerlo fisso, ma dovendo confrontare i risultati in modo rigoroso non si può fare

3) Ridurre il numero di selectors è difficile,
è evidente per qualche encoder specifico che qualche selector è in generale migliore ma non riusciamo a generalizzare tra tutti i casi

4) Unendo deep e radiomica non otteniamo grandi miglioramenti

5) tentare approccio usando meta classificatore(predizioni di due modelli come features)