Cardiac pathology prediction according to convolutional methods with kinematic features

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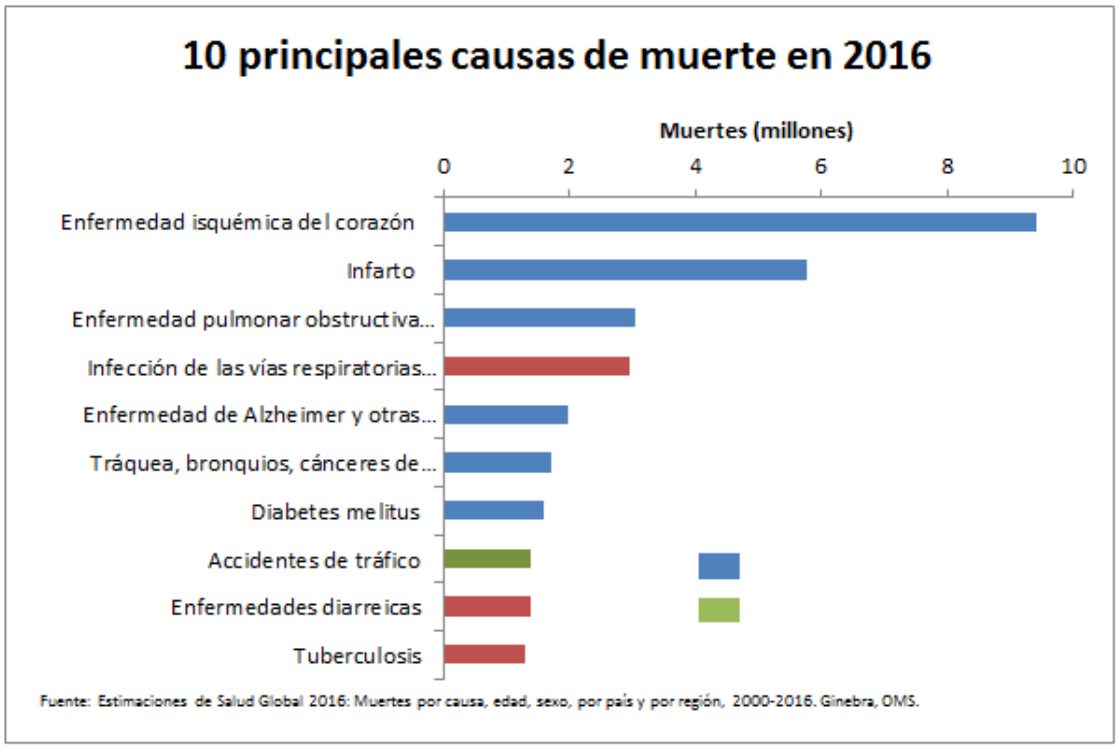
Introduction

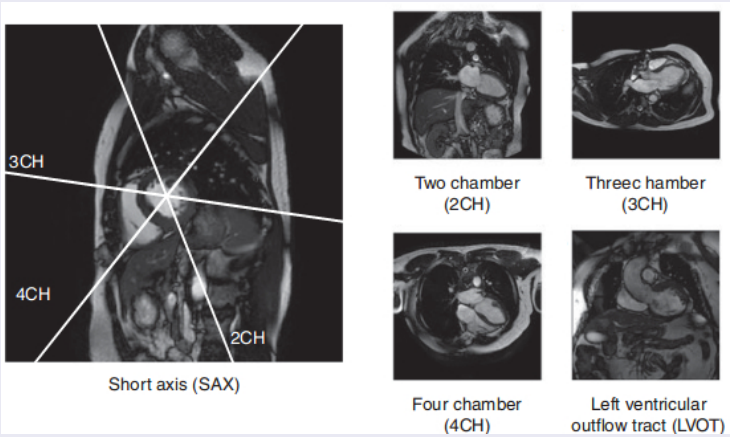
Motivation

- Cardiovascular diseases are leading causes of death around the world, more than 17,9 millions of deaths
- Lately the number of deaths have been incremented



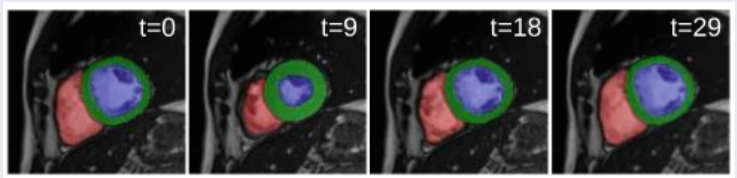
State of the art

J. Margeta *et al*,"*Fine-tuned convolutional neural networks for cardiac MRI acquisition plane recognition*"



- Predict chambers regarding acquisition views.
- Limited to global cine-MRI modeling.

F. Isensee *et al*, "*Automatic cardiac disease assessment on cine-MRI via time-series segmentation and domain specific features*"



- Depend on the segmentation task of ventricles.
- Lost motion information into the analysis.

Proposed method

Metodologia

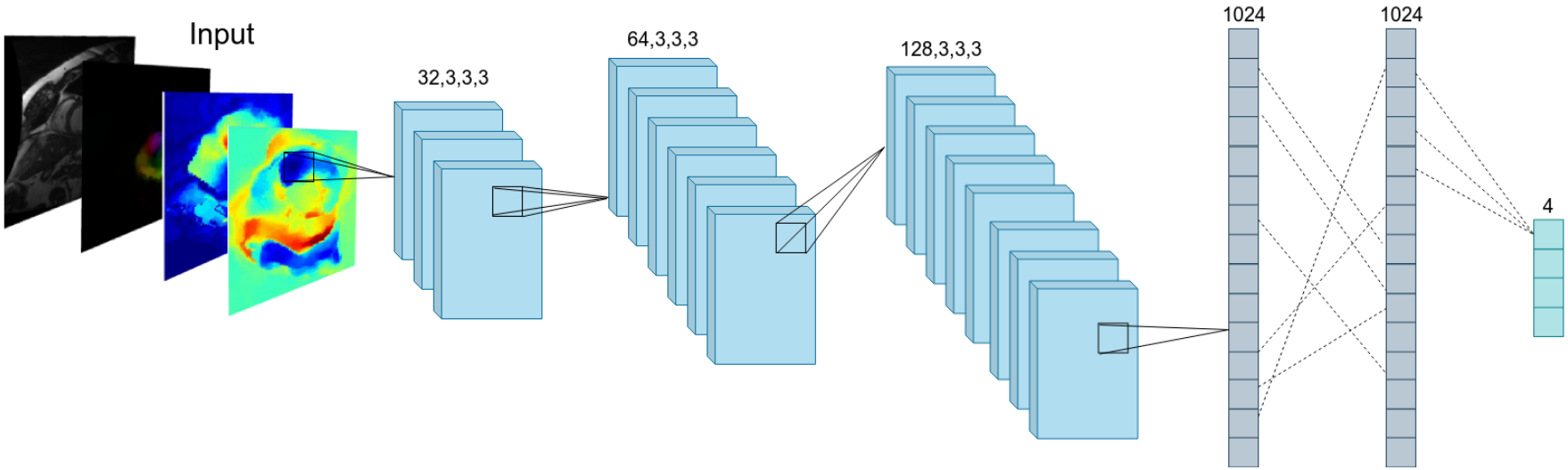
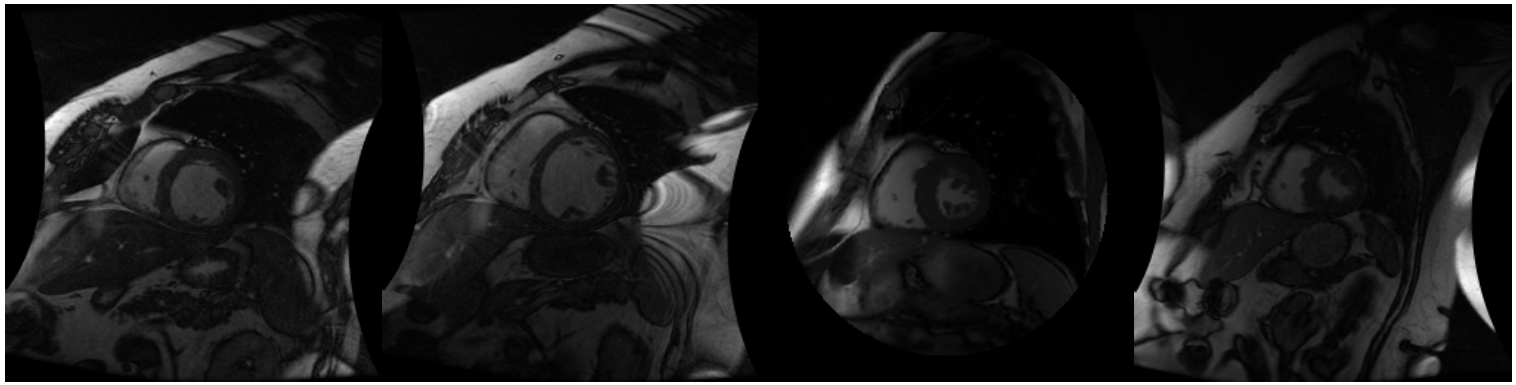


Fig 5. Arquitecture of Conv3D

Evaluation and results

Dataset

The dataset used in this approach was the Cardiac cine-MRI, proposed in a MICCAI challenge called SunnyBrook



- 45 patients (32 males and 13 women)
- 4 pathologies (HF-I, HF-NI, HYP, N)
- 256 x 256

Results of Binary Classifier

Cardiac	AN(%)		PPM(%)	
Disease	Accuracy	F1	Accuracy	F1
HF- I vs HF	60.87	64.00	47.83	53.85
HF-I vs HYP	47.82	50.00	26.09	32.00
HF-I vs N	30.00	22.22	60.00	66.67
HF vs HYP	26.17	26.08	41.67	41.67
HF vs N	33.33	22.22	38.09	38.09
HYP vs N	71.43	72.73	57.14	56.40
AVERAGE	44.94	42.88	45.14	48.10

Table 1. Binary classification to AN Kinematic

Results of Multi-class Classifier

Cardiac Disease	Accuracy (%)	F1-Score (%)
PPM	34.09	33.78
NA	27.27	25.90
TA	31.82	30.76

Table 2. Multi-class classifier with kinematics.

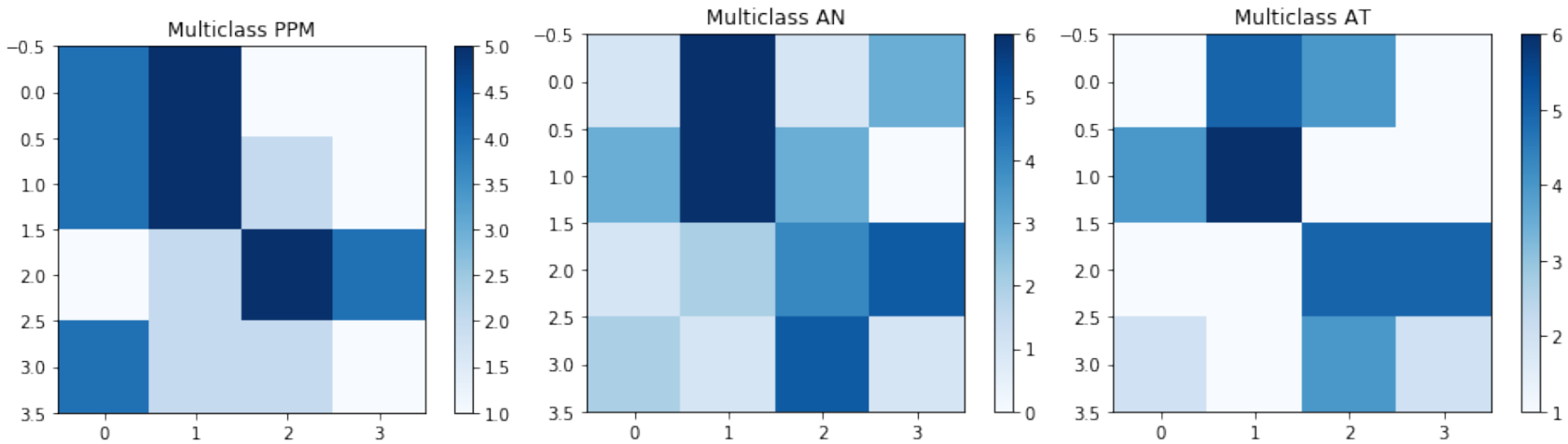


Fig 6. Confusion matrix PPM, NA and TA.

Result of Transfer Learning

Kinematics	TL(%)
Heart	71.02
Optical flow	34.68
Normal Aceleration	26.79

Table 3. Multi-class Transfer learning with kinematics

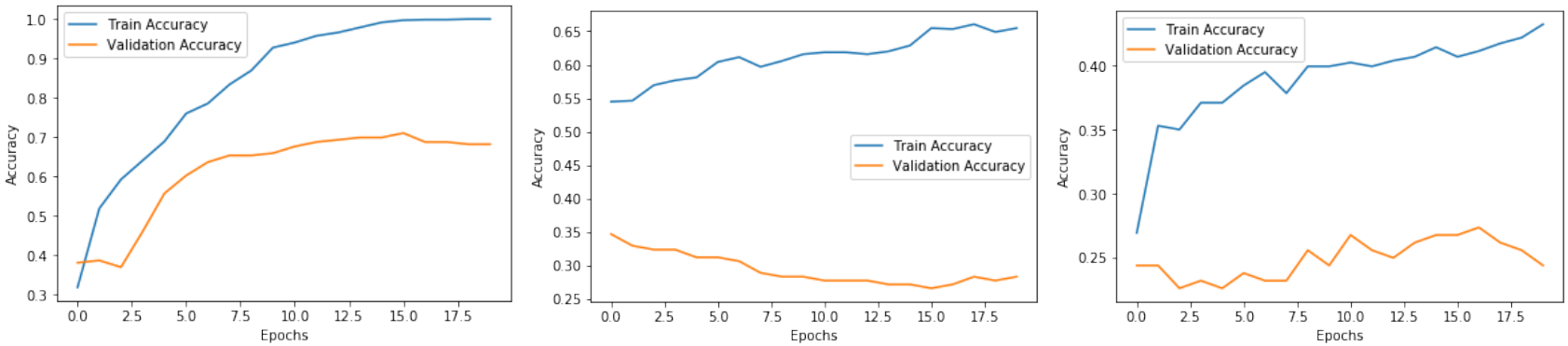


Fig 7. Graphic PPM, Flow and AN.

Results of Deep features

Kinematics	RF(%)	SVM(%)	DNN(%)
Heart	1.0	1.0	1.0
Optical flow	78.85	73.46	30.38
Normal Aceleration	75.29	71.71	53.39

Table 4. Multi-class Deep features with kinematics

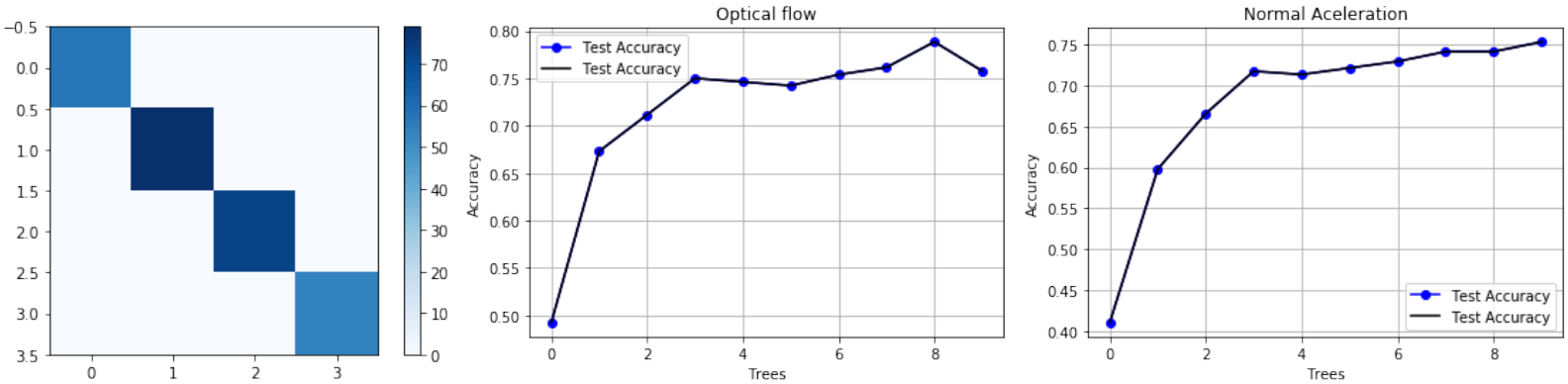


Fig 8. Confusion matrix PPM and test of RF.

Result of Transfer Learning

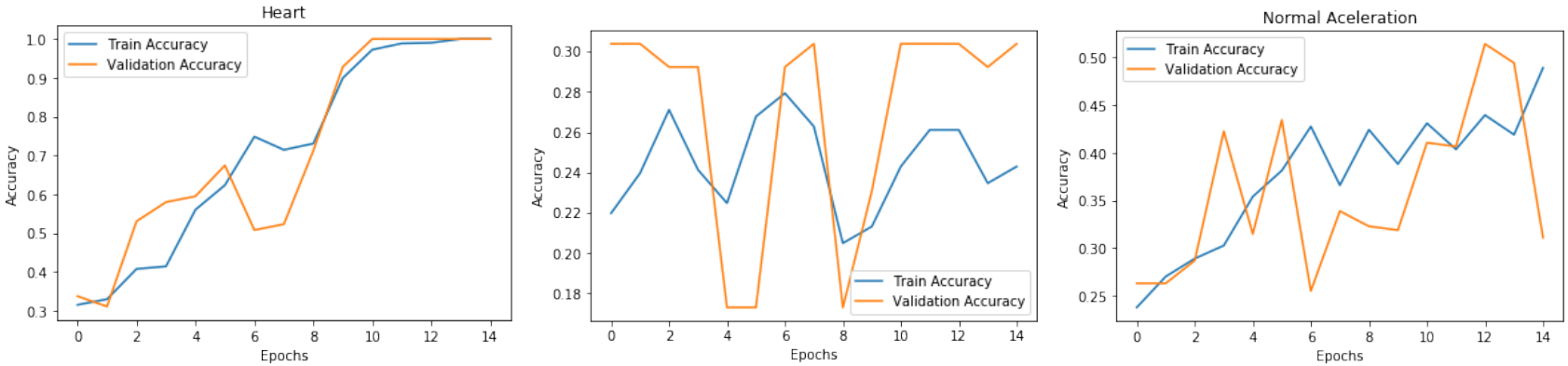


Fig 9. Graphic PPM, Flow and AN.

THANK YOU!

- https://github.com/AlejandraM97/VISION-CODE/tree/master