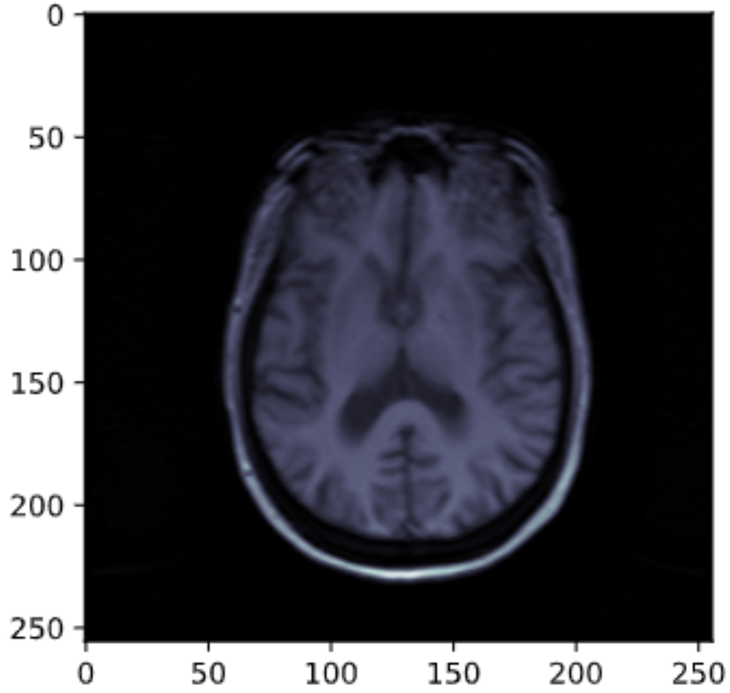
CNeuronalN Disease

Alzheimer Disease Predictions

18th March, 2021



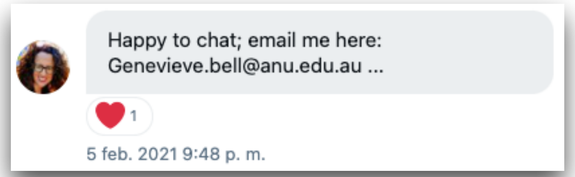
Ariadna Puigventós

Data Scientist

Analytics & Insight Specialist

..index

..abstract project



All starts with this tweet.
She's Anthropologist & ethics in AI

It is talking about the ethic of AI in medicine and their evolution and Human tasks in companies.

Entrevista al Dr. Neurólogo del Hospital del Mar de Barcelona

+

pasqual maragall foundation
A FUTURE WITHOUT ALZHEIMER

Neurologist, researcher and leader the HEBE project

+

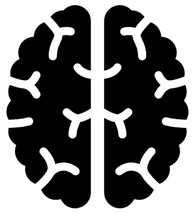


Image Axial Dataset

Clinic Dataset (Numérico/ categórico)

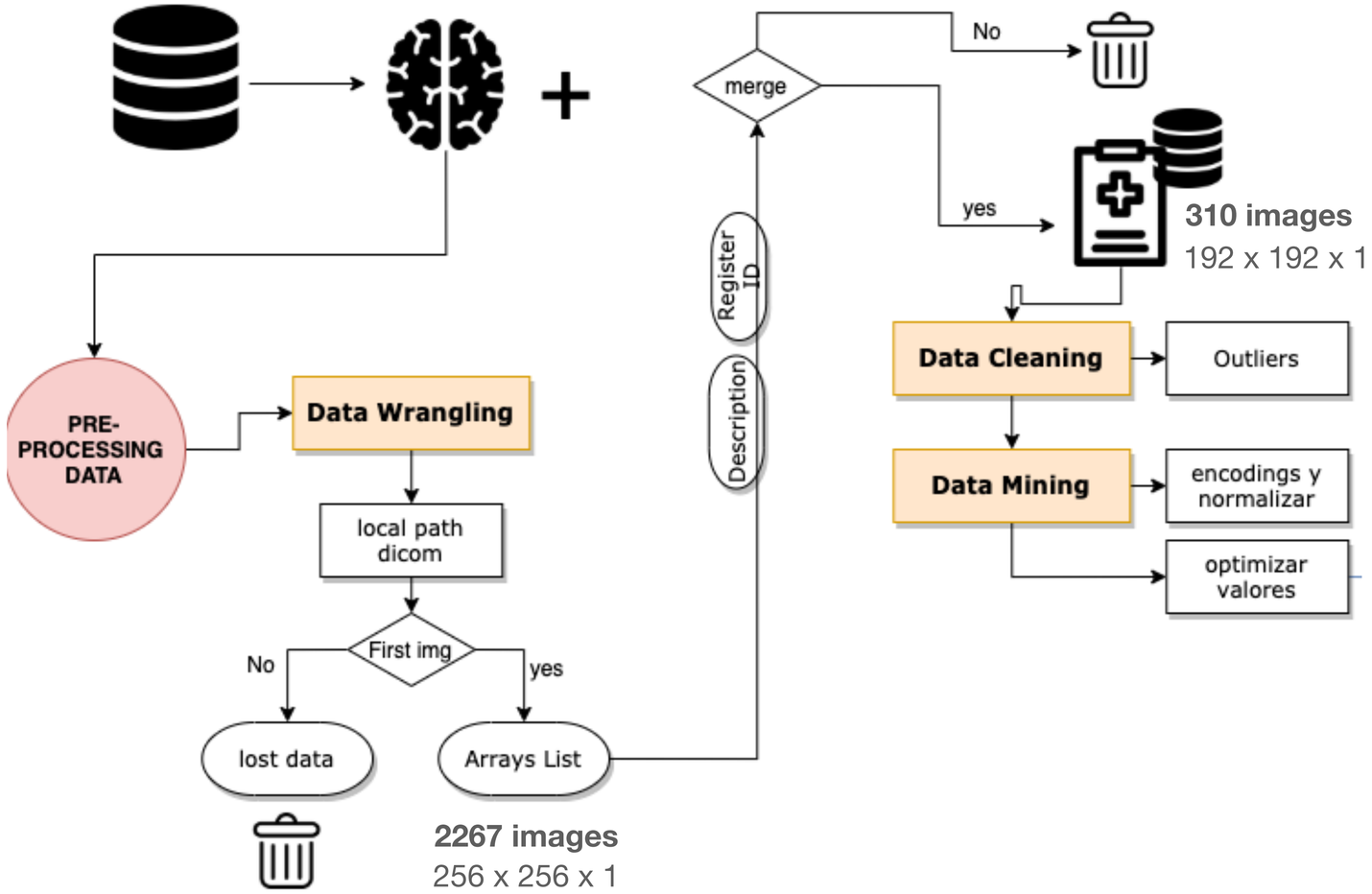
..abstract project

Image Axial Dataset

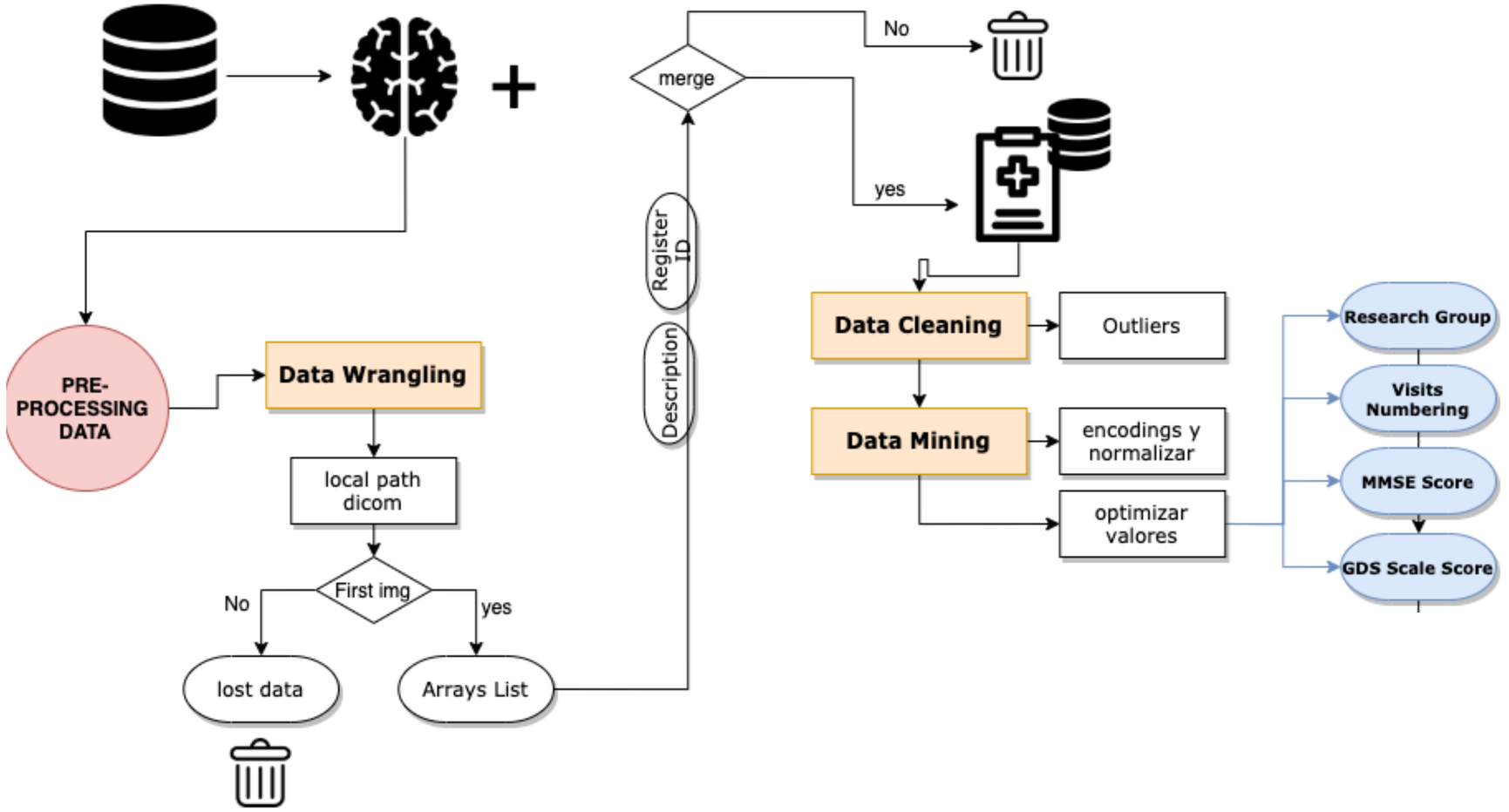
Clinic Dataset (Numérico/ categórico)

	Subject ID	Phase	Sex	Weight	Research Group	APOE A2	Visit	Study Date	Age	MMSE Total Score	GDSCALE Total Score	Global CDR	Description
0	002_S_0729	ADNI 2	F	75.3	MCI	4	ADNI2 Year 2 Visit	8/16/2013	72.3	24.0	1.0	1.0	3 Plane Localizer
1	002_S_1070	ADNI 1	M	88.4	MCI	3	ADNI1/GO Month 24	12/11/2008	75.8	19.0	1.0	1.0	3-plane localizer
2	002_S_1070	ADNI 1	M	88.4	MCI	3	ADNI1/GO Month 24	12/11/2008	75.8	19.0	1.0	1.0	SURVEY
3	003_S_4892	ADNI 2	F	81.6	AD	4	ADNI2 Year 1 Visit	9/19/2013	76.3	26.0	4.0	1.0	Calibration Scan
4	003_S_4892	ADNI 2	F	81.6	AD	4	ADNI2 Year 1 Visit	9/19/2013	76.3	26.0	4.0	1.0	3 Plane Localizer

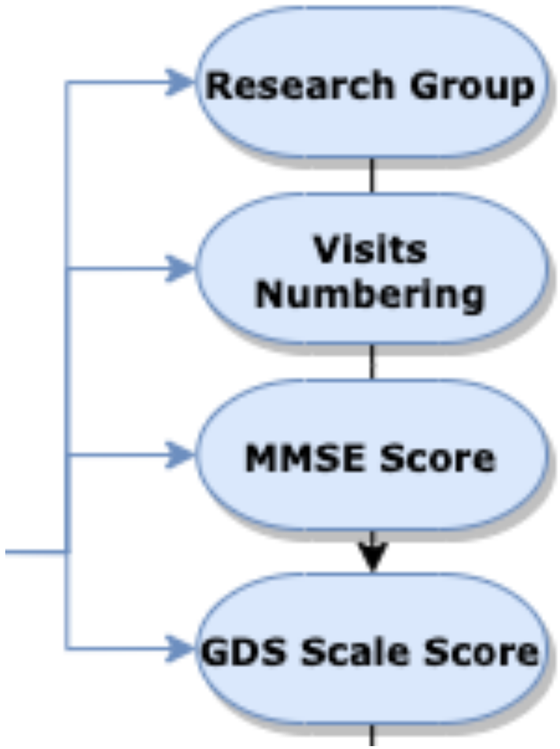
..work planning



..work planning



..first: understand Alzheimer Disease



{AD: Alzheimer Disease: 2, MCI: Normal Cognitive: 1}

VISIT NUMBERING

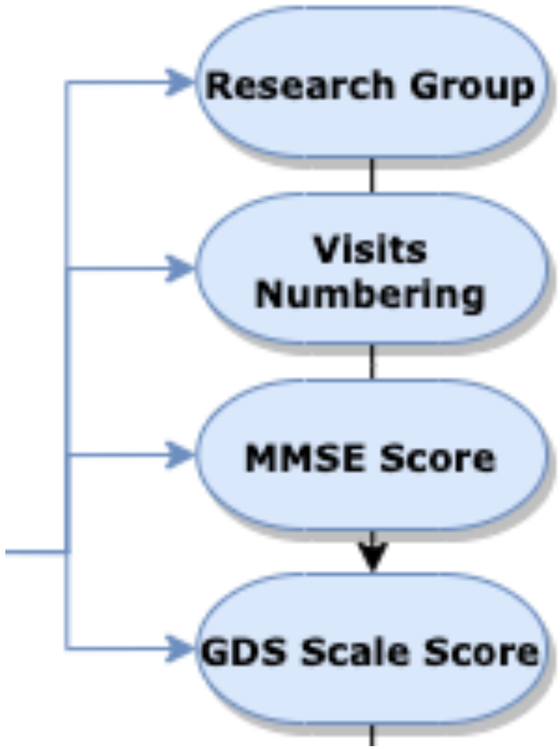
VISIT	NUMBER	ABBREVIATION	LICENSE PLATE
Baseline	2	VST 2	200000 - 299999
Month 6	3	VST 3	300000 - 399999
Month 12	4	VST 4	400000 - 499999
Month 24	6	VST 6	600000 - 699999
Month 36	7	VST 7	700000 - 799999
Month 48	8	VST 8	800000 - 899999
Month 60	9	VST 9	900000 - 999999
Month 72	10	VST 10	1000000 - 1099999
Month 84	11	VST 11	1100000 - 1199999
Month 96	12	VST 12	1200000 - 1299999
Month 108	13	VST 13	1300000 - 1399999
Month 120	14	VST 14	1400000 - 1499999

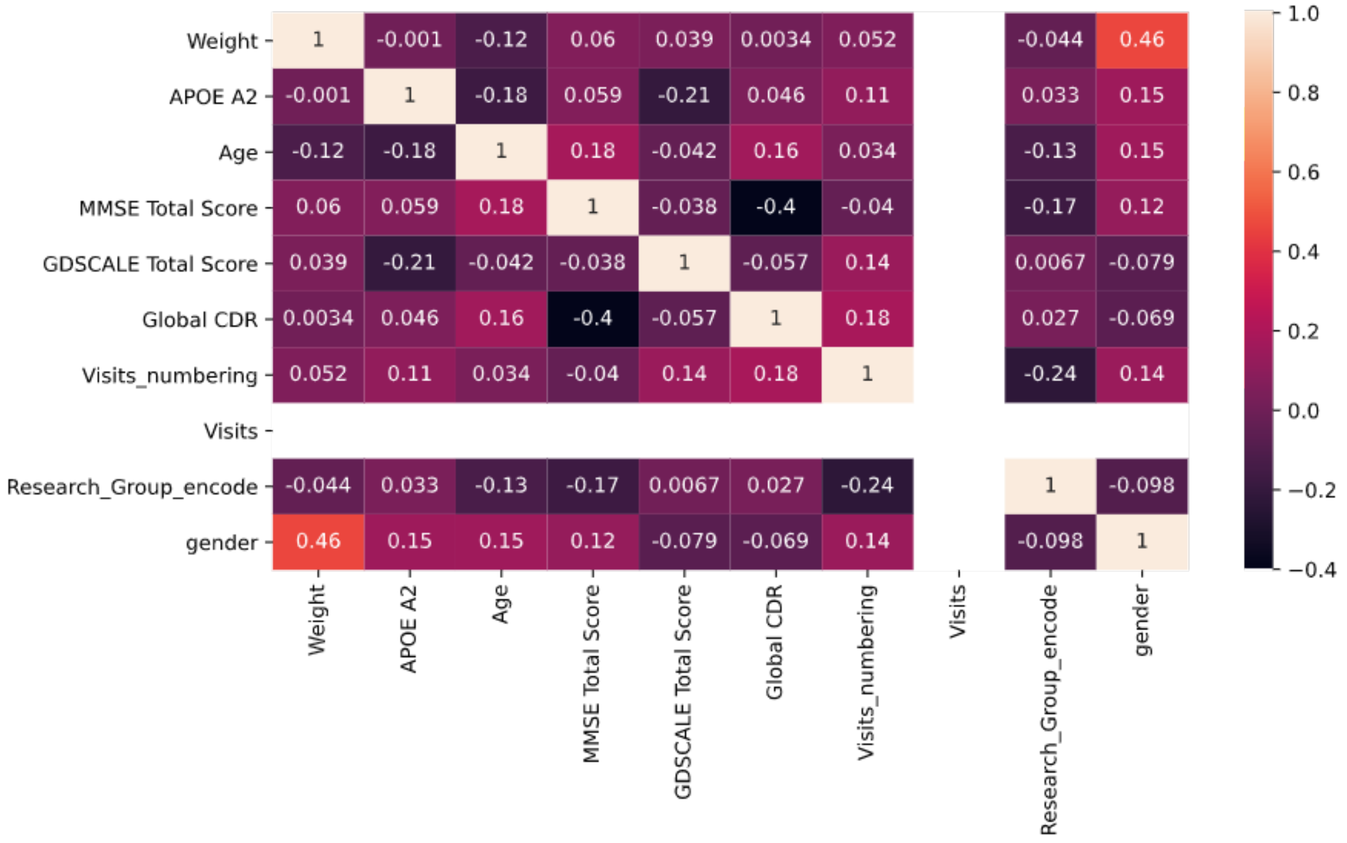
Psichomotricity tests

MMSE: [26 - 30] —> GDS Scale Score 1
MMSE: [25 - 29] —> GDS Scale Score 2
MMSE: [20 - 27] —> GDS Scale Score 3
MMSE: [18 - 23] —> GDS Scale Score 4
MMSE: [16 - 20] —> GDS Scale Score 5
MMSE: [10 - 19] —> GDS Scale Score 6
MMSE: [5 - 15] —> GDS Scale Score 7
MMSE: [0 - 12] —> GDS Scale Score 8

 # It allows a MAE < 3 points

..first: understand Alzheimer Disease





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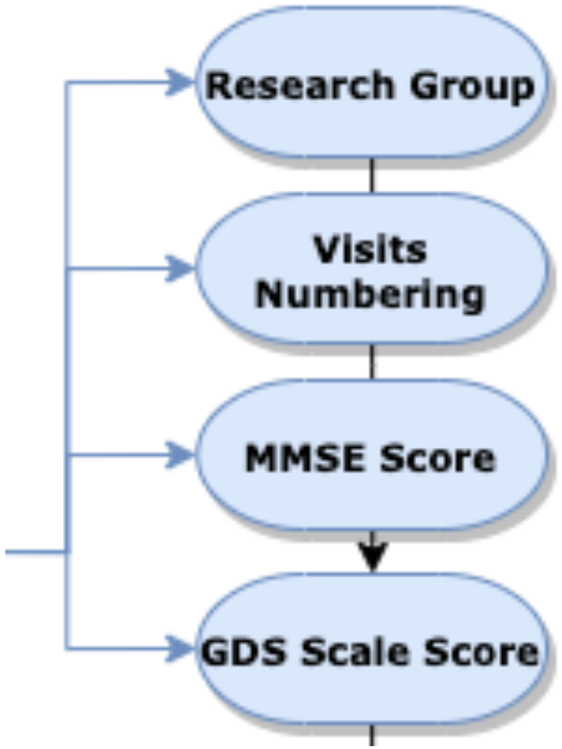

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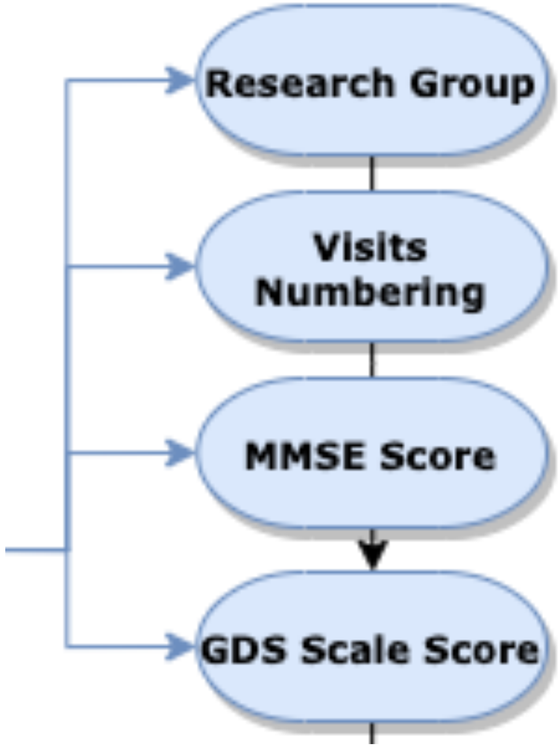

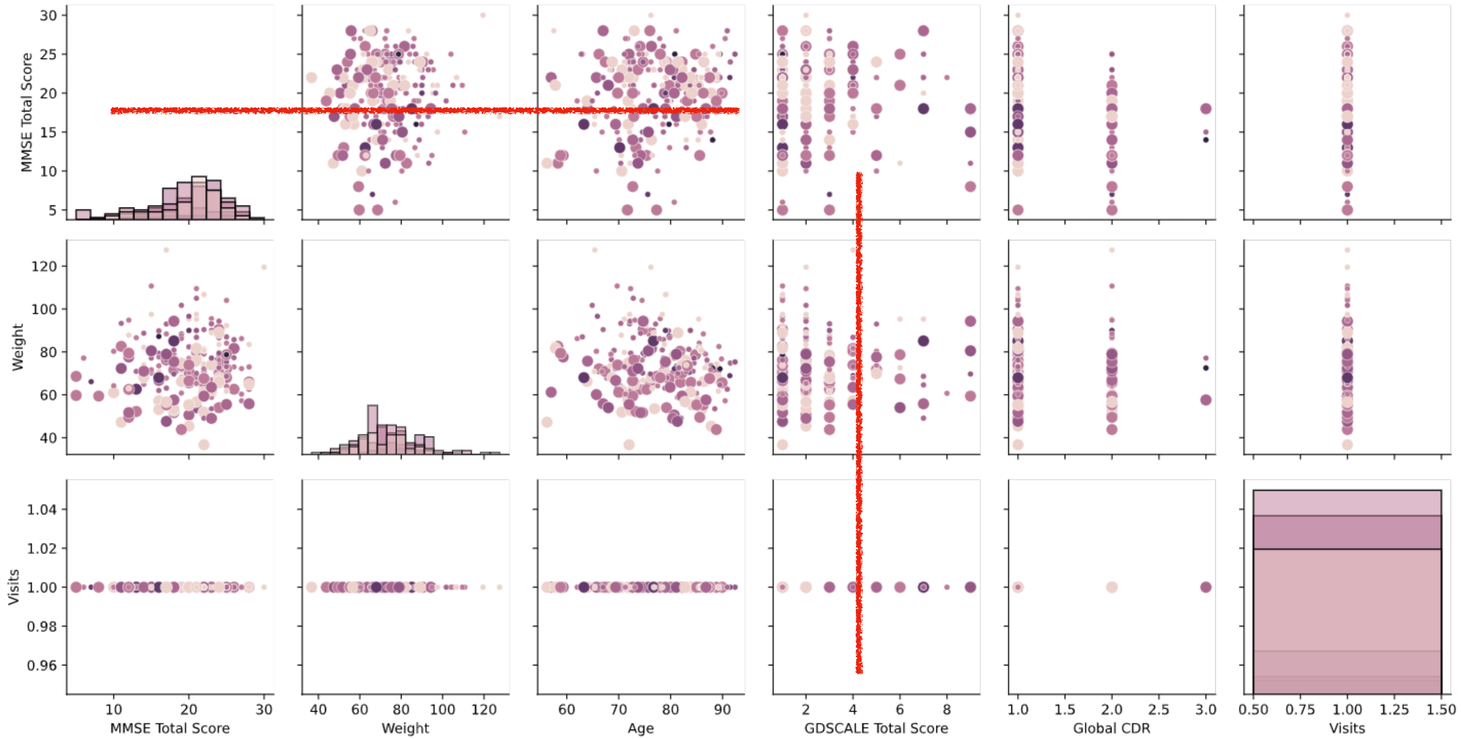

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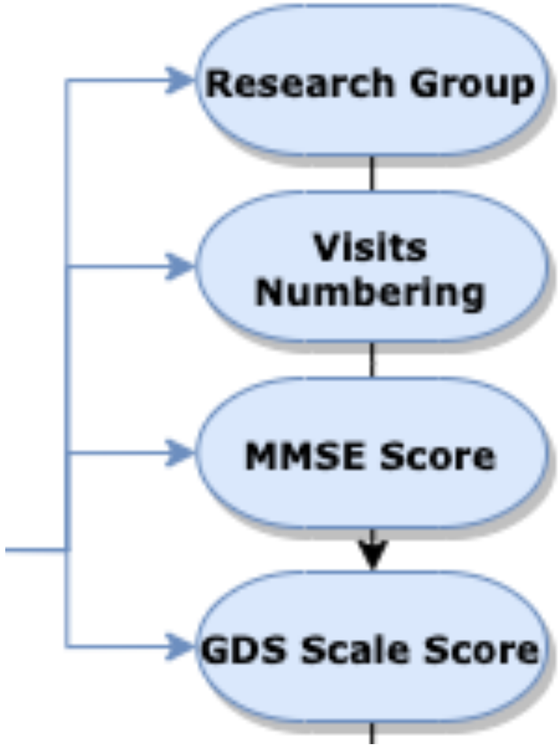

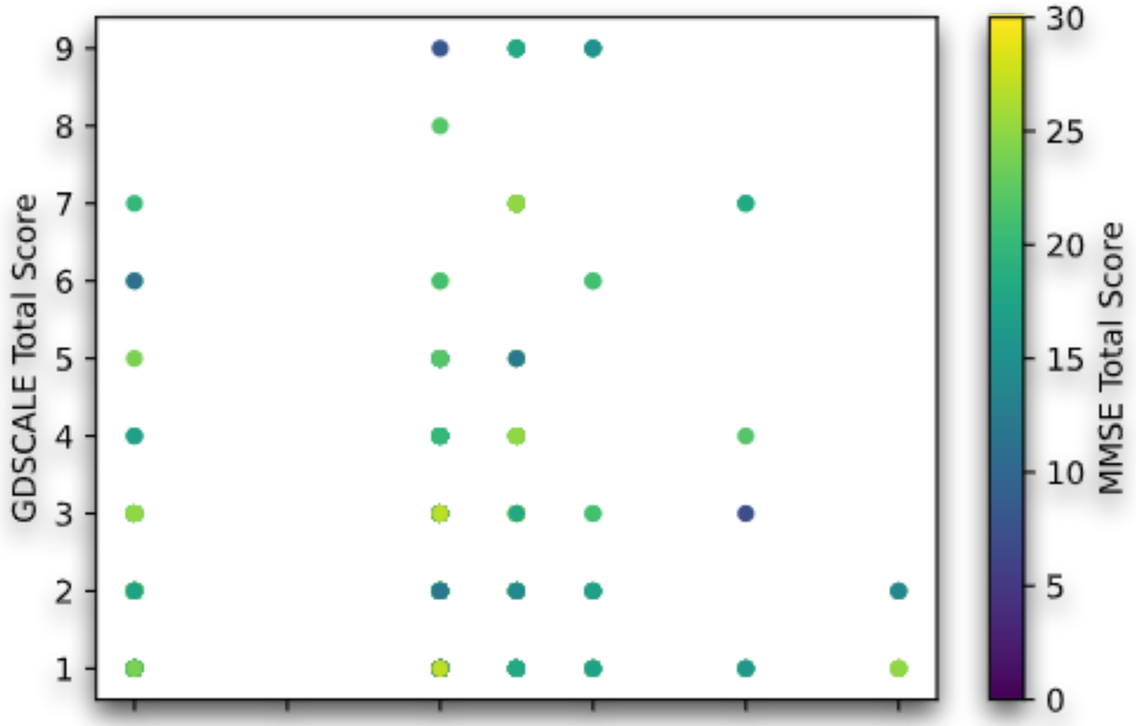

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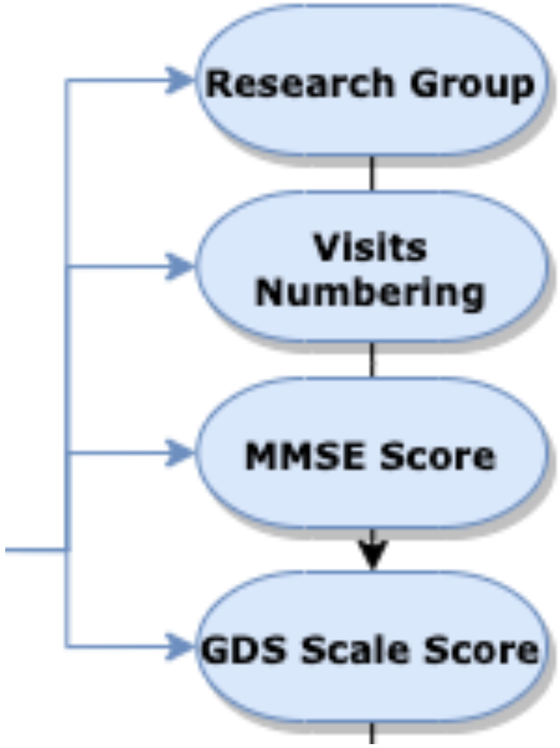
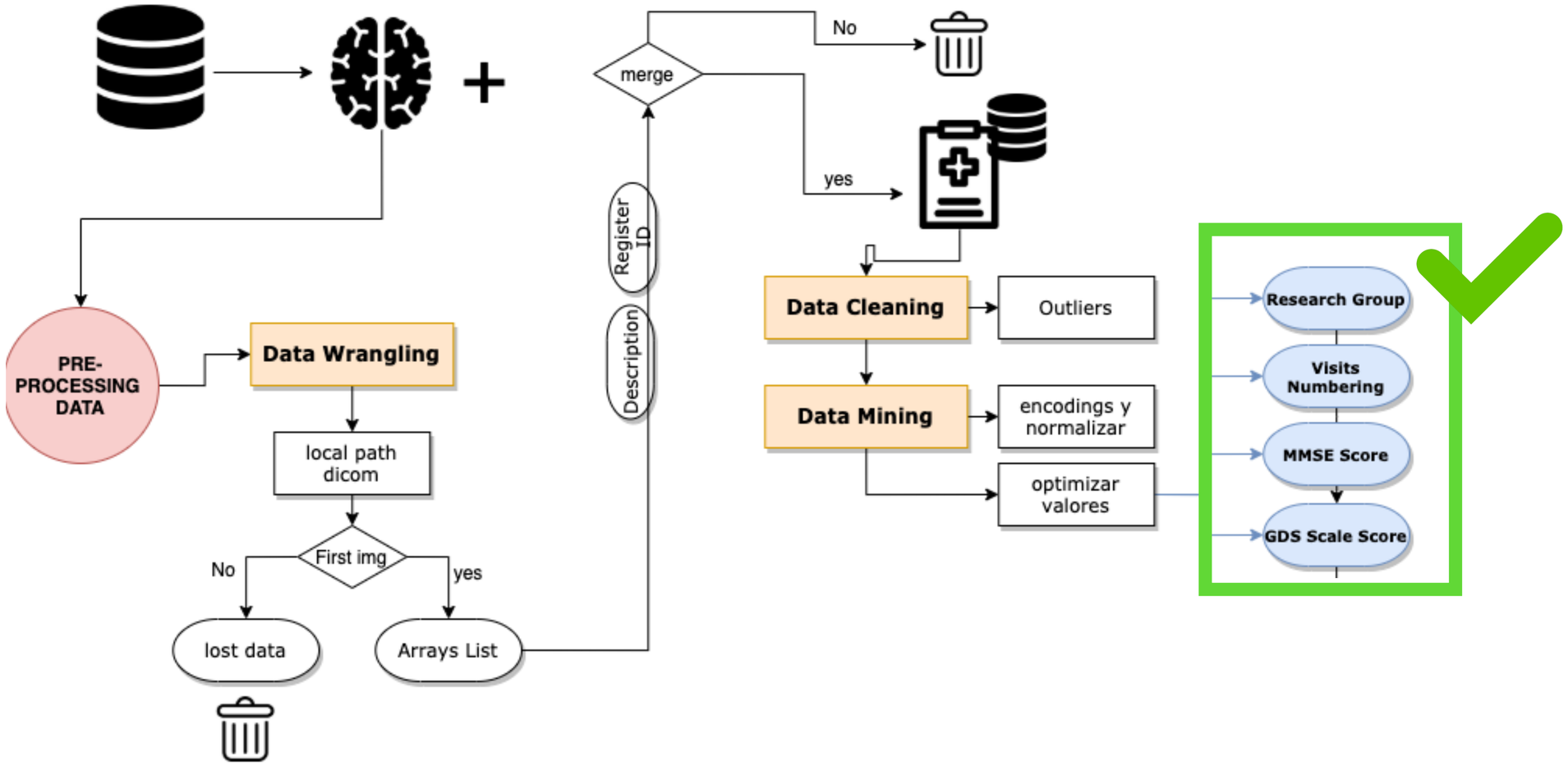
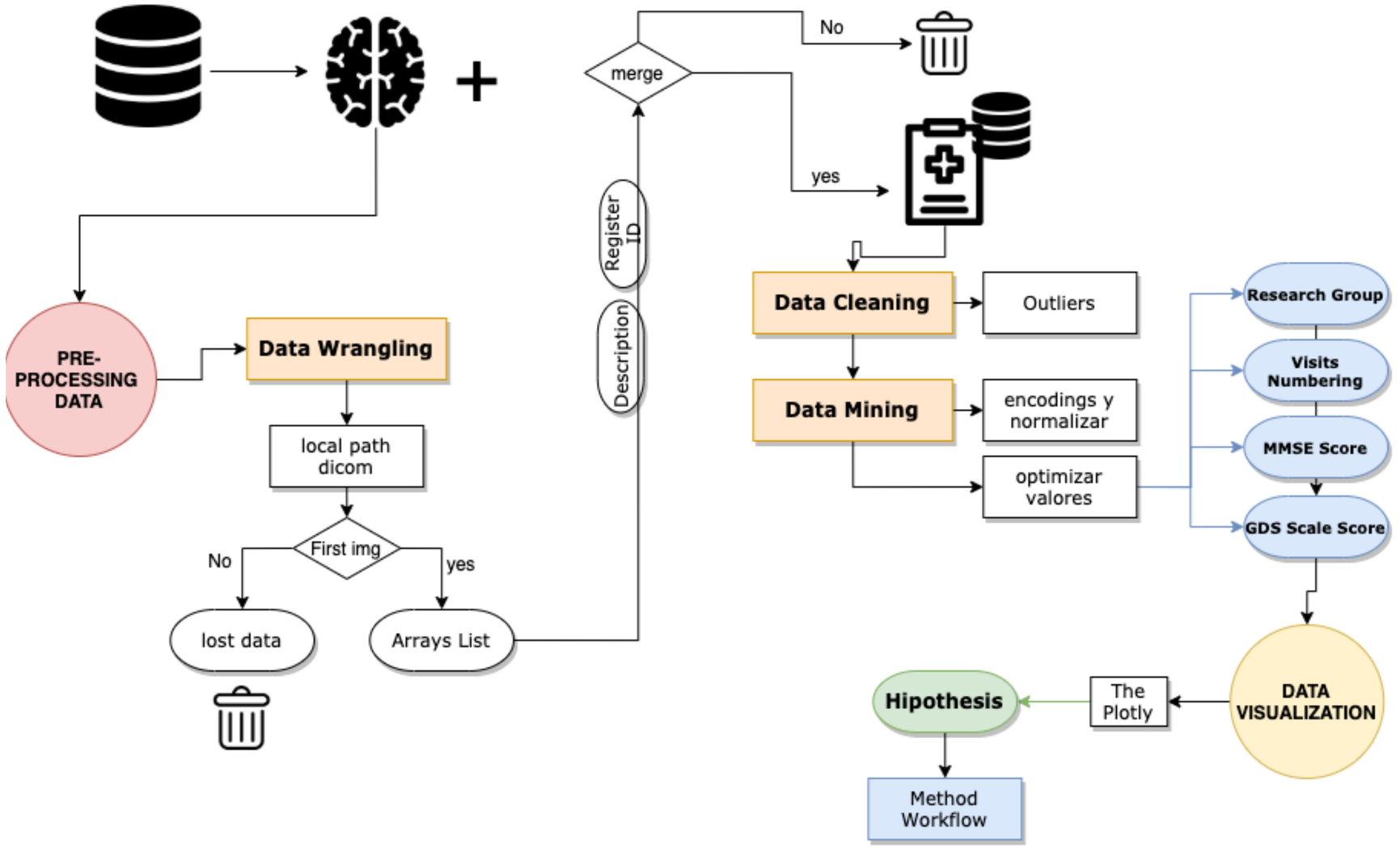


..work planning



..work planning



..hyphotesis

Whether the disease of the patient correlates with the number of visits the patient have (or has had them) to know the capacity of a hospital.

..prediction

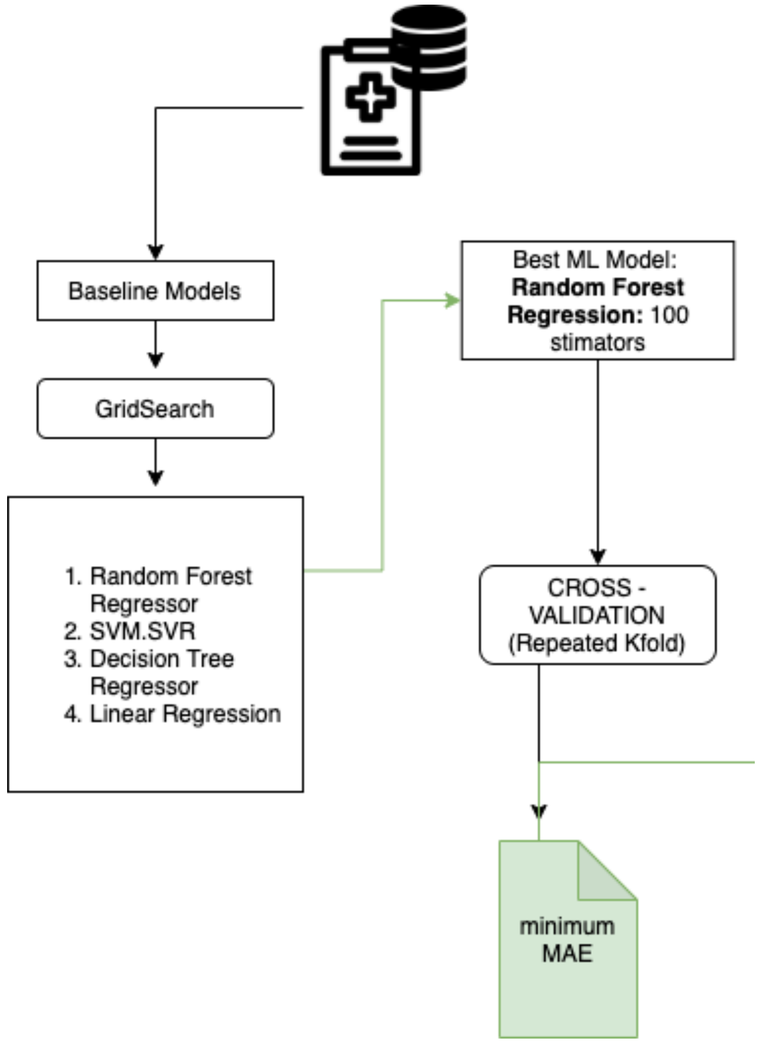
How **serious is the patient's diagnosis (GDS Scale Score)**
because for allowing to know **MMSE Score**
and which the patient is part of **Research Group** as well.

..y

Regressor Problem	Classifier Problem
MMSE Score	GDS Scale Score

..method workflow

..1

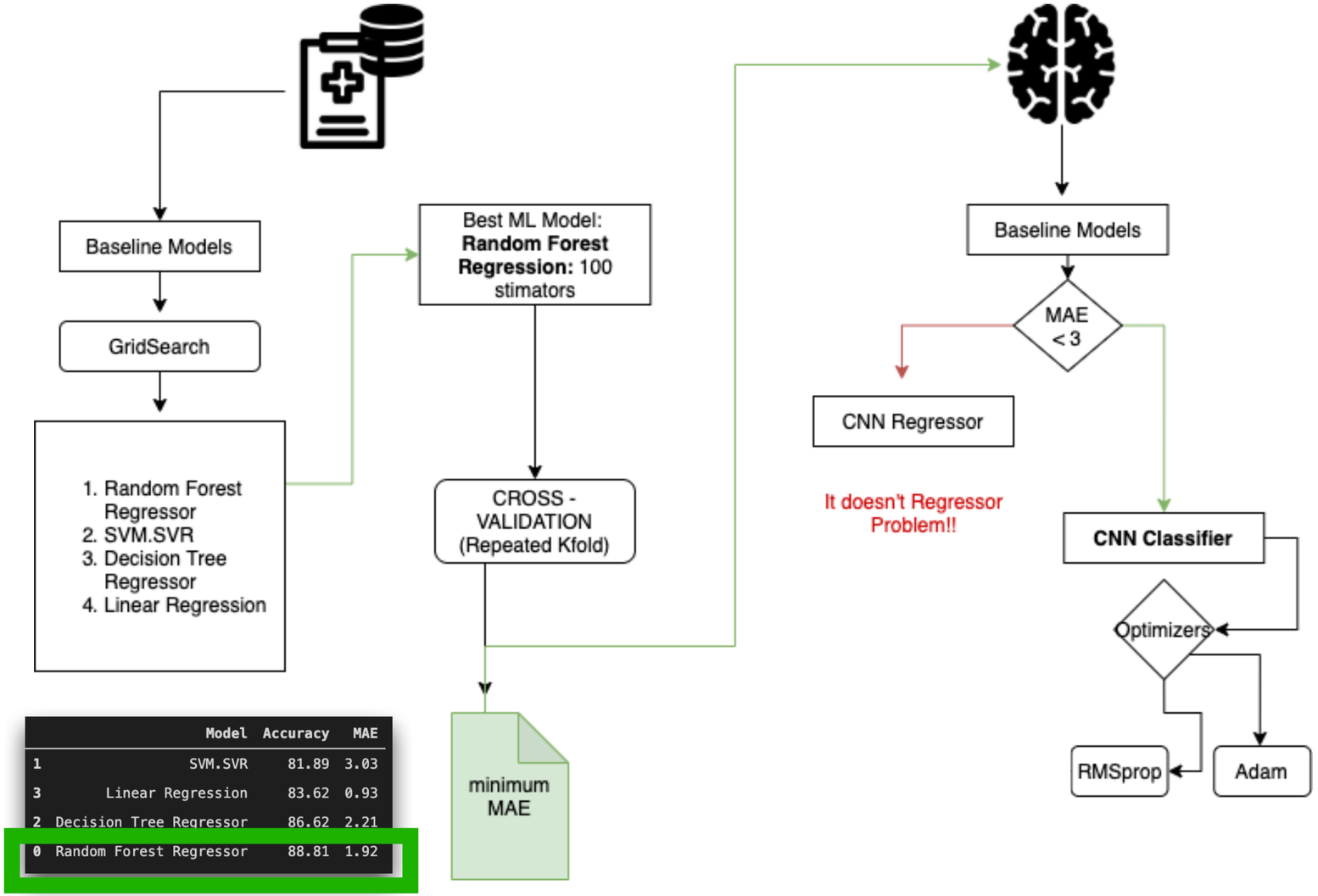


MMSE Score { **Regressor Problem**

	Model	Accuracy	MAE
1	SVM.SVR	81.89	3.03
3	Linear Regression	83.62	0.93
2	Decision Tree Regressor	86.62	2.21
0	Random Forest Regressor	88.81	1.92

..method workflow

..2



	Model	Accuracy	MAE
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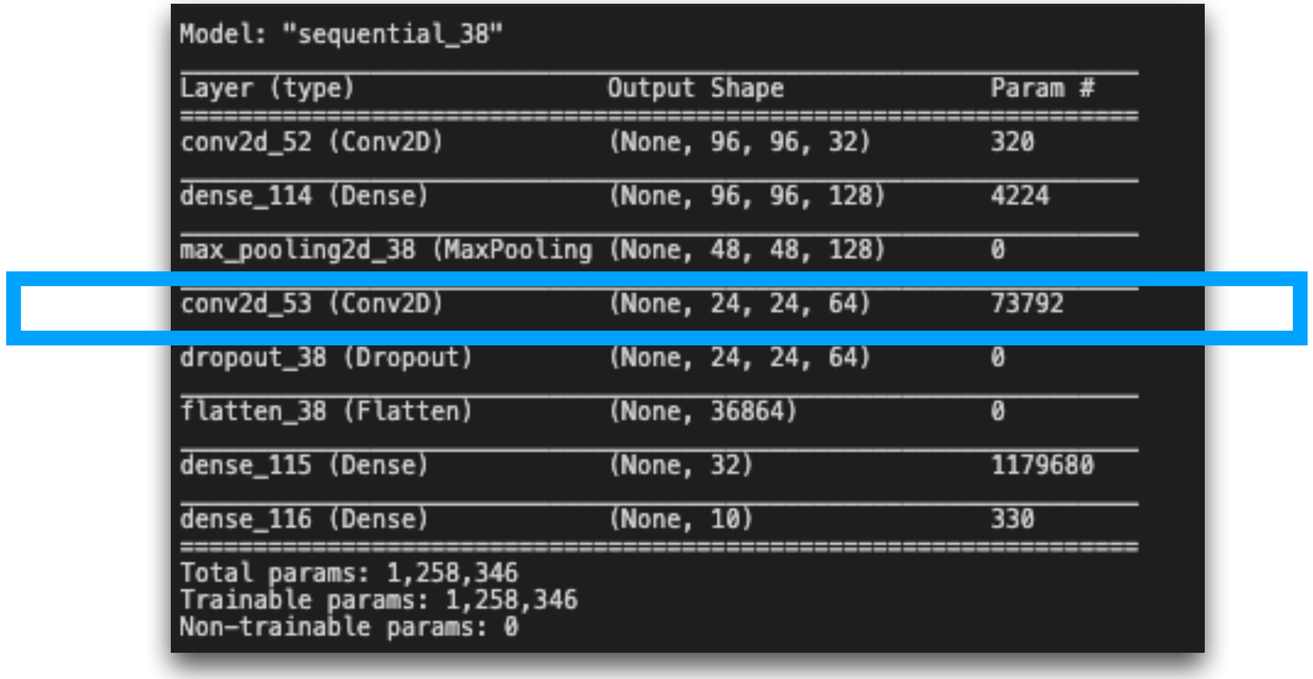
..method workflow

RNN Classifier:
- **Optimizer: Adam**
- Loss: Sparse_categorical_crossentropy
- **Metrics: accuracy**

RNN Classifier:
- **Optimizer: RMSprop**
- Loss: Sparse_categorical_crossentropy
- **Metrics: accuracy + MAE**



```
Model: "sequential_38"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_52 (Conv2D)           (None, 96, 96, 32)        320
_________________________________________________________________
dense_114 (Dense)            (None, 96, 96, 128)       4224
_________________________________________________________________
max_pooling2d_38 (MaxPooling (None, 48, 48, 128)       0
_________________________________________________________________
conv2d_53 (Conv2D)           (None, 24, 24, 64)        73792
_________________________________________________________________
dropout_38 (Dropout)         (None, 24, 24, 64)        0
_________________________________________________________________
flatten_38 (Flatten)         (None, 36864)             0
_________________________________________________________________
dense_115 (Dense)            (None, 32)                1179680
_________________________________________________________________
dense_116 (Dense)            (None, 10)                330
=================================================================
Total params: 1,258,346
Trainable params: 1,258,346
Non-trainable params: 0
```

..method workflow

RNN Classifier:
- **Optimizer: Adam**
- Loss: Sparse_categorical_crossentropy
- **Metrics: accuracy**

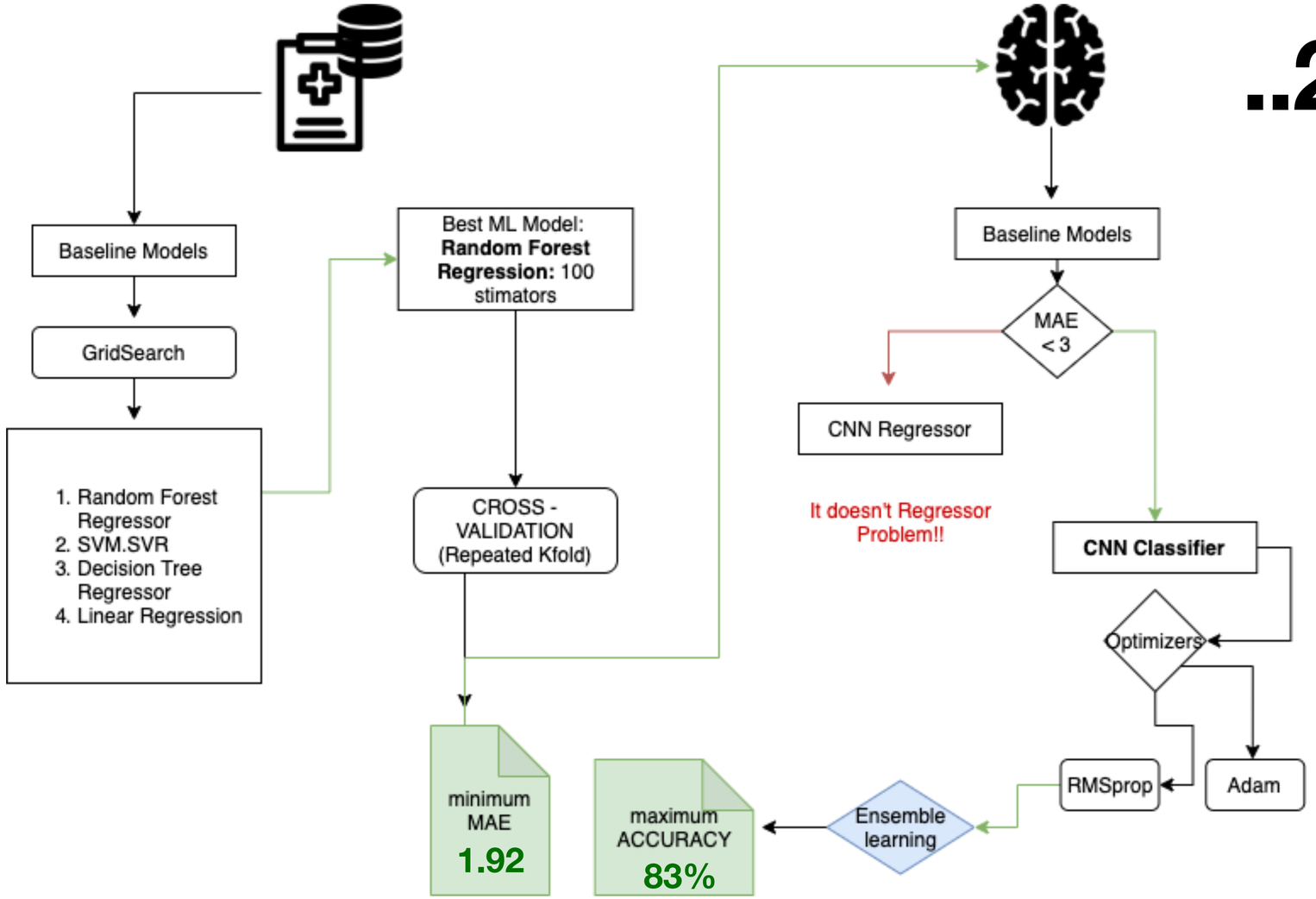
	loss	mae	val_loss	val_mae	epoch
25	2.145077	2.145077	3.334012	3.334012	25
26	1.590204	1.590204	3.704018	3.704018	26
27	2.439020	2.439020	3.125645	3.125645	27
28	2.220982	2.220982	3.803301	3.803301	28
29	2.244222	2.244222	3.190500	3.190500	29

RNN Classifier:
- **Optimizer: RMSprop**
- Loss: Sparse_categorical_crossentropy
- **Metrics: accuracy + MAE**

	loss	accuracy	mae	val_loss	val_accuracy	val_mae
0	7.225995	0.183784	2.521622	5.721313	0.106383	2.176596
1	2.103894	0.367568	2.521622	1.274105	0.382979	2.176596
2	1.272152	0.529730	2.521622	1.234786	0.531915	2.176596
3	1.290524	0.491892	2.521622	1.305777	0.382979	2.176596
4	1.079257	0.583784	2.521622	1.002876	0.617021	2.176596
18	0.339169	0.881081	2.521622	1.699437	0.553191	2.176596
19	0.295855	0.891892	2.521622	2.929947	0.489362	2.176596
20	0.229541	0.913514	2.521622	3.059832	0.489362	2.176596
21	0.216091	0.913514	2.521622	3.331850	0.489362	2.176596
22	0.262699	0.902703	2.521622	2.061542	0.468085	2.176596

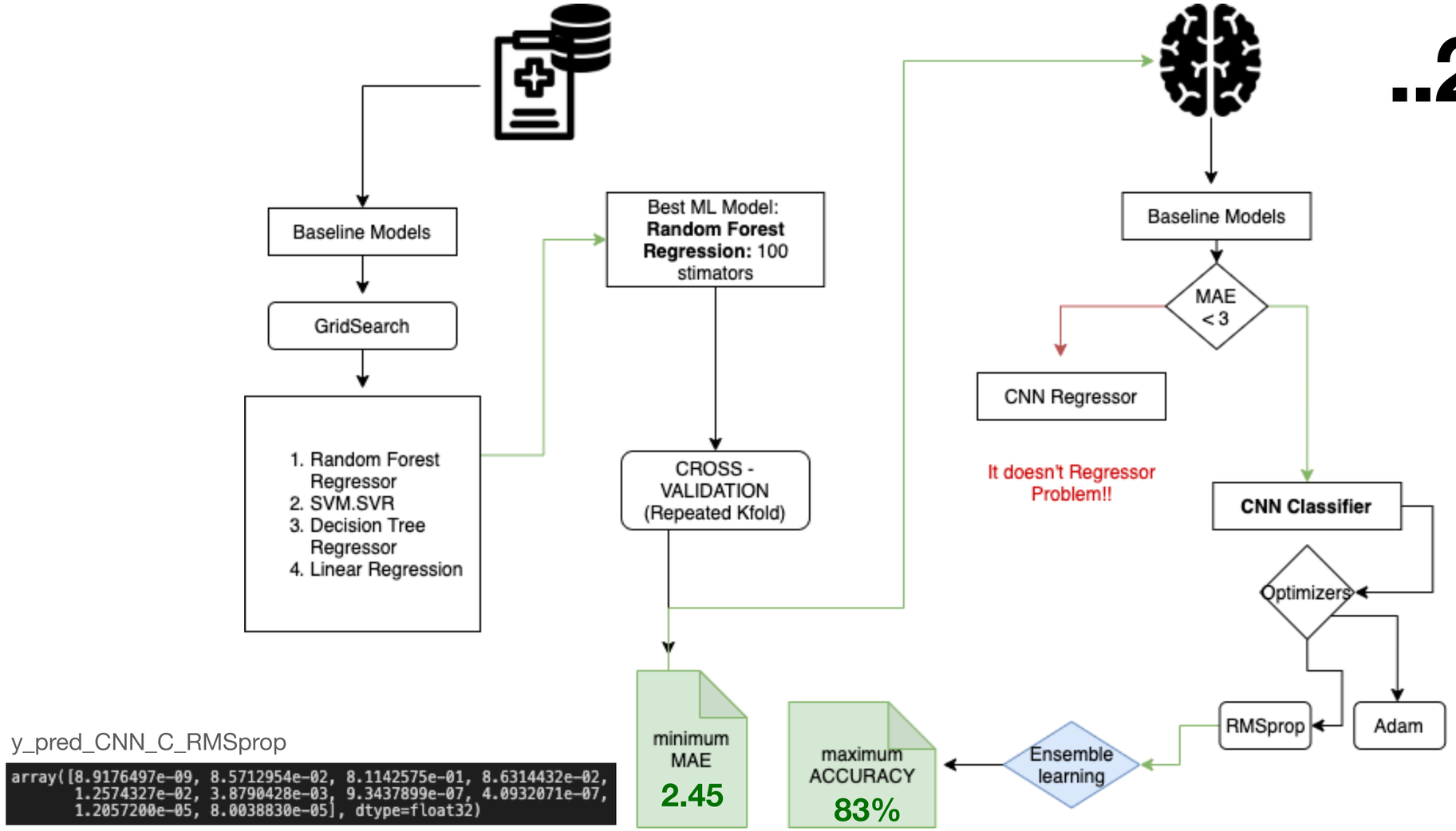
..method workflow

..2



..method workflow

..2



y_pred_CNN_C_RMSprop

```
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       1.2574327e-02, 3.8790428e-03, 9.3437899e-07, 4.0932071e-07,
       1.2057200e-05, 8.0038830e-05], dtype=float32)
```

..bonus track theory

RNN LSTM, what's happening?

Customers Review 2,491

Thanos

September 2018

Verified Purchase

Amazing! This box of cereal gave me a perfectly balanced breakfast, as all things should be. I only ate half of it but will definitely be buying again!

A Box of Cereal

$3.99

Amazing! This box of cereal gave me a **perfectly balanced breakfast**, as all things should be. I only ate half of it but **will definitely be buying again!**

Source: townrdsdatascience

..bonus track theory

RNN LSTM, what's happening?

- STM short-term-memory tries to hold back keywords in a temporal series (past and present).
- They have internal mechanisms called gates that an regulate the flow of information.
- They carry relevant information throughout of the sequence, so the earlier steps can make it's way to later time steps, reducing the effects of STM.

Source: townrdsdatascience

..next steps

- Predict visits numbering by MMSE/GDS with all images per patient/visit.
- Keep going with LSTM practical model with AD project
- Regarding this project with ethics issues in medicine and another human fields.
- Get hardware and software resources.
- Upload a predicted image to the API works.

..thanks

al Covid-19

al mal tiempo

al AVE

a Apple Support

…y no menos importante a…

¡A vosotros!

Gabriel, Clara, Dio, tocayo, Javis, Álex, Mar de amore, Xelitas, Alfonso,

Leo-nil, Migueles, Estela, Juan I, ==lentejas (Robert), María, Kapilin, Anais, Andreea.