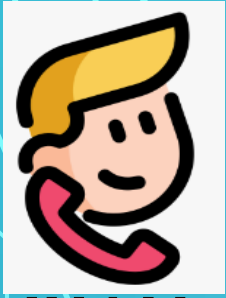




ESTIMACION DE LA CALIDAD DE AUDIO EN LLAMADAS TELEFÓNICAS (VoIP)

Llamada VOIP (Voice over IP)



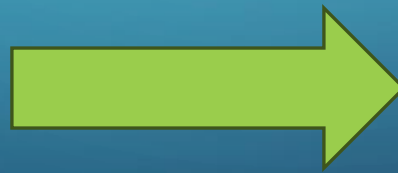
JUAN



PEDRO

PROBLEMAS

1. Paket Loss
2. Latency
3. Jitter



Calidad de la llamada

MOS
(Mean Opinion Score)
ITU-T

call quality analysis ITU-T G.107

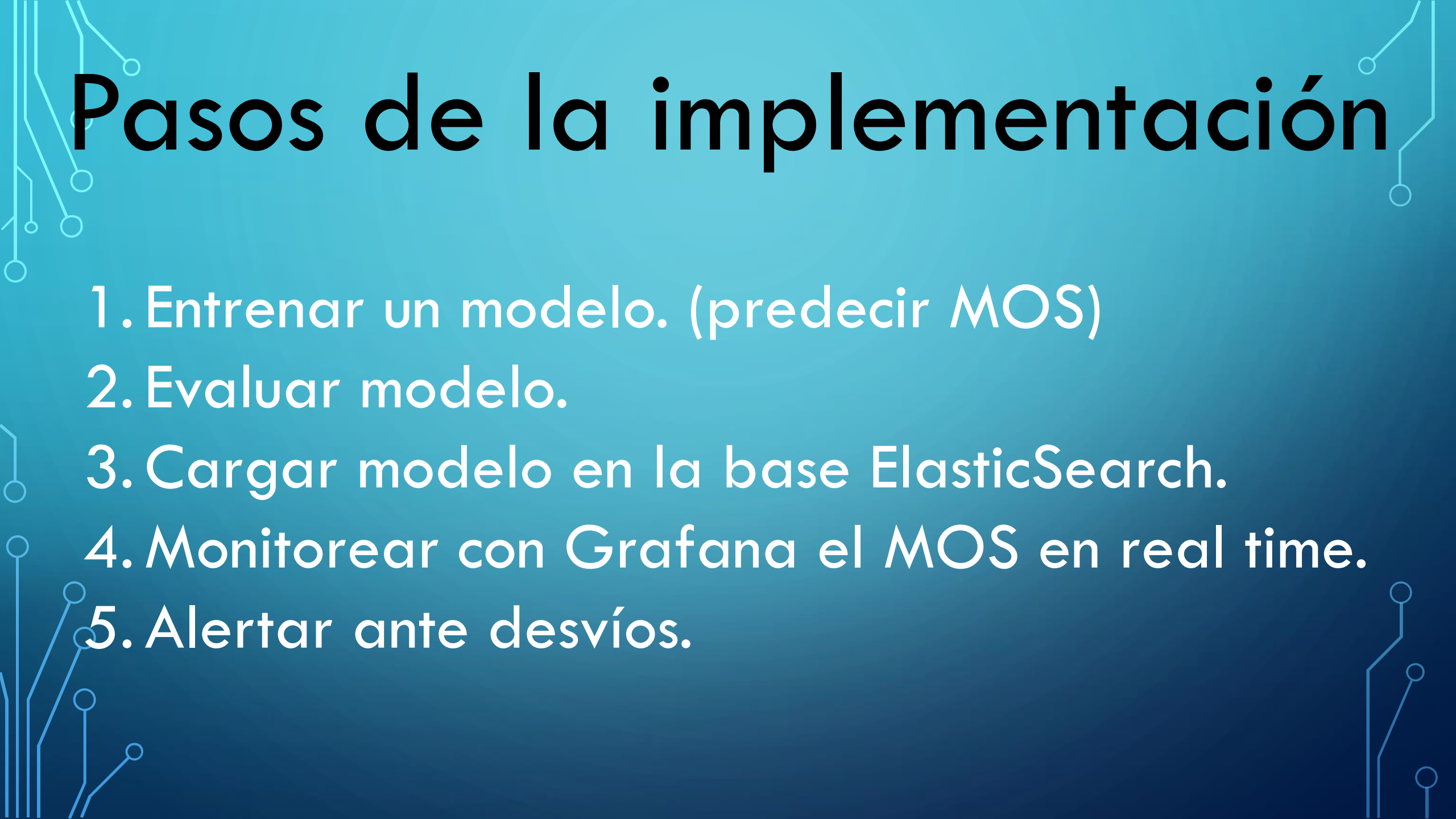
MOS metric	Quality	Description	Impact on viewers
5	Excellent	Perfect content	Highly satisfied
4	Good	With some distortion, but without inconvenience to the viewer	Some dissatisfied users
3	Regular	With distortions that cause inconvenience to the viewer	Many dissatisfied users
2	Poor	Low quality that produce a very annoying perception	Not recommended



The diagram illustrates the 4G LTE network architecture, showing the User Equipment (UE), Radio Access Network (RAN), and Core Network (CN). The architecture is divided into three planes: User plane (red), Control plane (blue), and Combination of user and control planes (green). Key components include HeNB, eNB, MME, HSS/AuC, S-GW, P-GW, PCRF, S-CSCF, P-CSCF, IMS-MGW, and PDN-GW. The diagram also shows the connection to the Internet via a globe icon. A legend at the bottom right explains the color coding for the planes.

- User plane
- Control plane
- Combination of user and control planes

Figure 4. EPC and IMS simulation for VoLTE



Pasos de la implementación

1. Entrenar un modelo. (predecir MOS)
2. Evaluar modelo.
3. Cargar modelo en la base Elasticsearch.
4. Monitorear con Grafana el MOS en real time.
5. Alertar ante desvíos.

Viavi csv

Entradas

Average_Jitter_Uplink_S1U

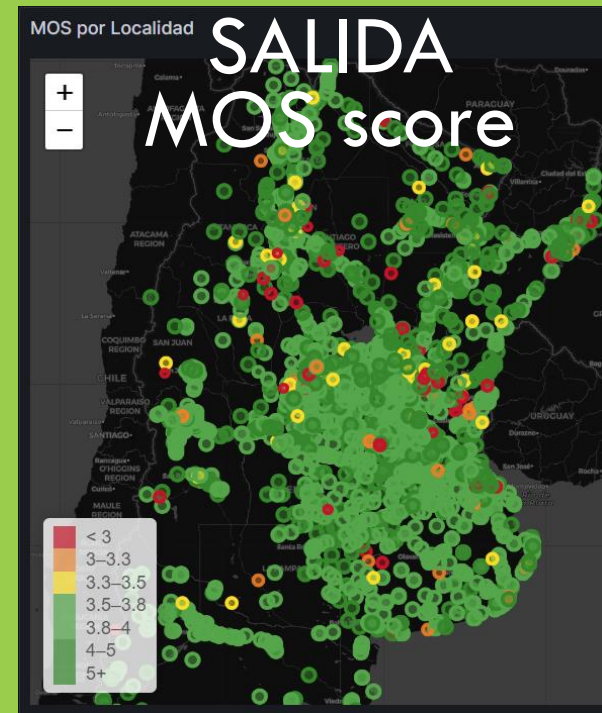
Average_Latency_Uplink_S1U

Average_One_Way_Audio_Uplink_S1U

Average_Packet_Loss_Uplink_S1U



ESTIMACION IA



ENTRENAMIENTO

NITRO Mobile™

Performance Explorer

Customer Experience Assurance



Mobile Control
Plane

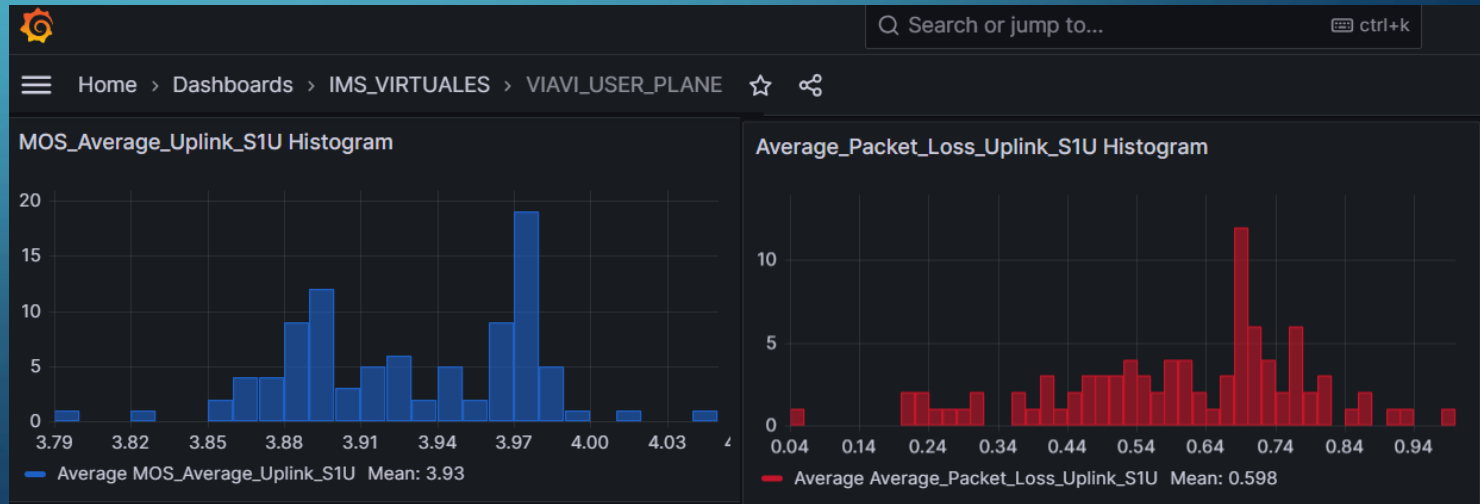
VIavi



Mobile Control
Plane



Mobile Voice
(VoLTE)



DATASET (csv by Viavi)

ENTRADA

df.describe()

	Average_Jitter_Uplink_S1U (ms)	Average_Latency_Uplink_S1U (ms)	Average_One_Way_Audio_Uplink_S1U	Average_Packet_Loss_Uplink_S1U (%)	MOS_Average_Uplink_S1U
count	55096.000000	55096.000000	55096.000000	55096.000000	55096.000000
mean	10.720333	49.468343	16.120190	0.657283	4.010397
std	9.792482	5.166832	25.142074	1.674674	0.181058
min	0.460000	6.120000	0.000000	0.000000	1.140000
25%	7.590000	50.000000	0.000000	0.040000	3.960000
50%	9.090000	50.000000	4.000000	0.160000	4.050000
75%	10.800000	50.000000	23.000000	0.510000	4.110000
max					4.240000

Jitter

Latency

One way audio

Packet
Loss

MOS. UL S1U
Valor a predecir

Sentido UPLINK



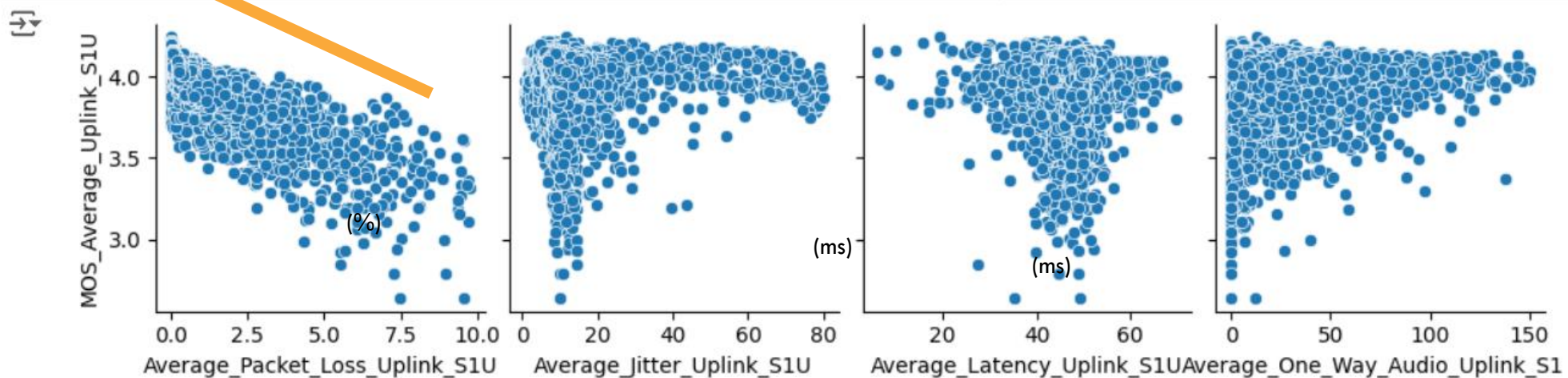
**Packet
Loss**

Jitter

Latency

One way audio

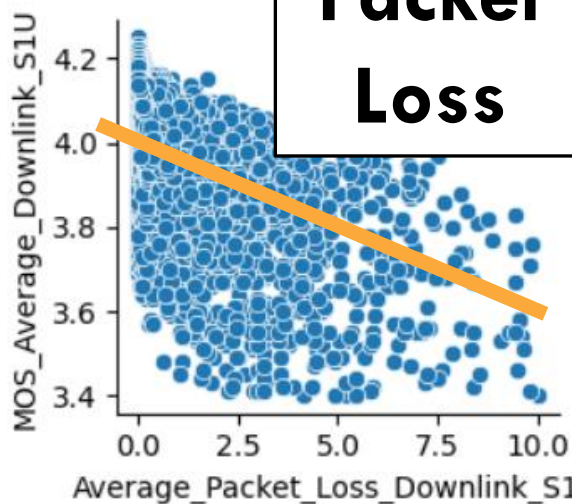
```
sns.pairplot(  
    x_vars=["Average_Packet_Loss_Uplink_S1U", "Average_Jitter_Uplink_S1U", "Average_Latency_Uplink_S1U", "Average_One_Way_Audio_Uplink_S1U"],  
    y_vars=["MOS_Average_Uplink_S1U"]);
```



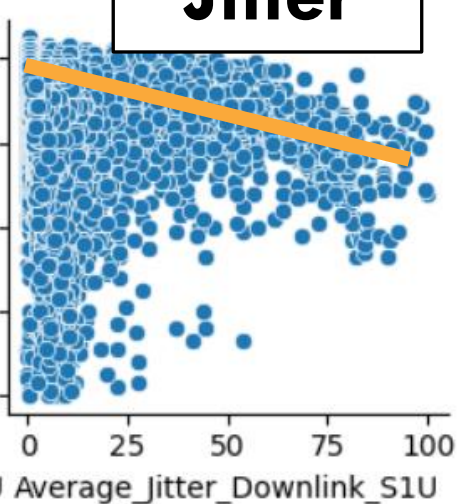
Sentido DOWNLINK



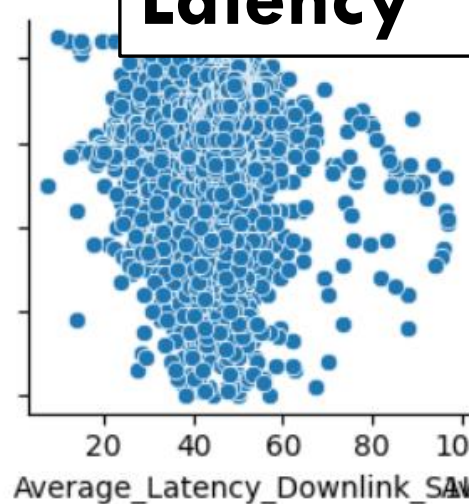
**Packet
Loss**



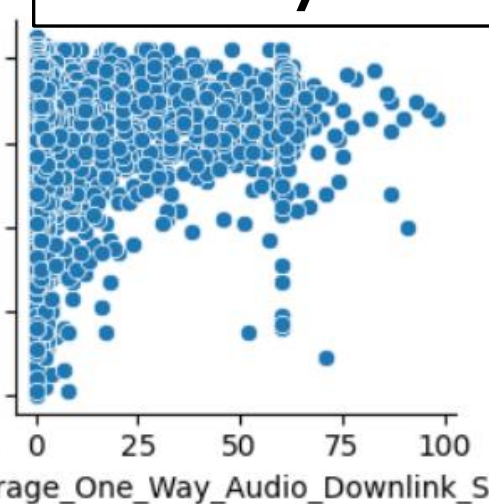
Jitter



Latency



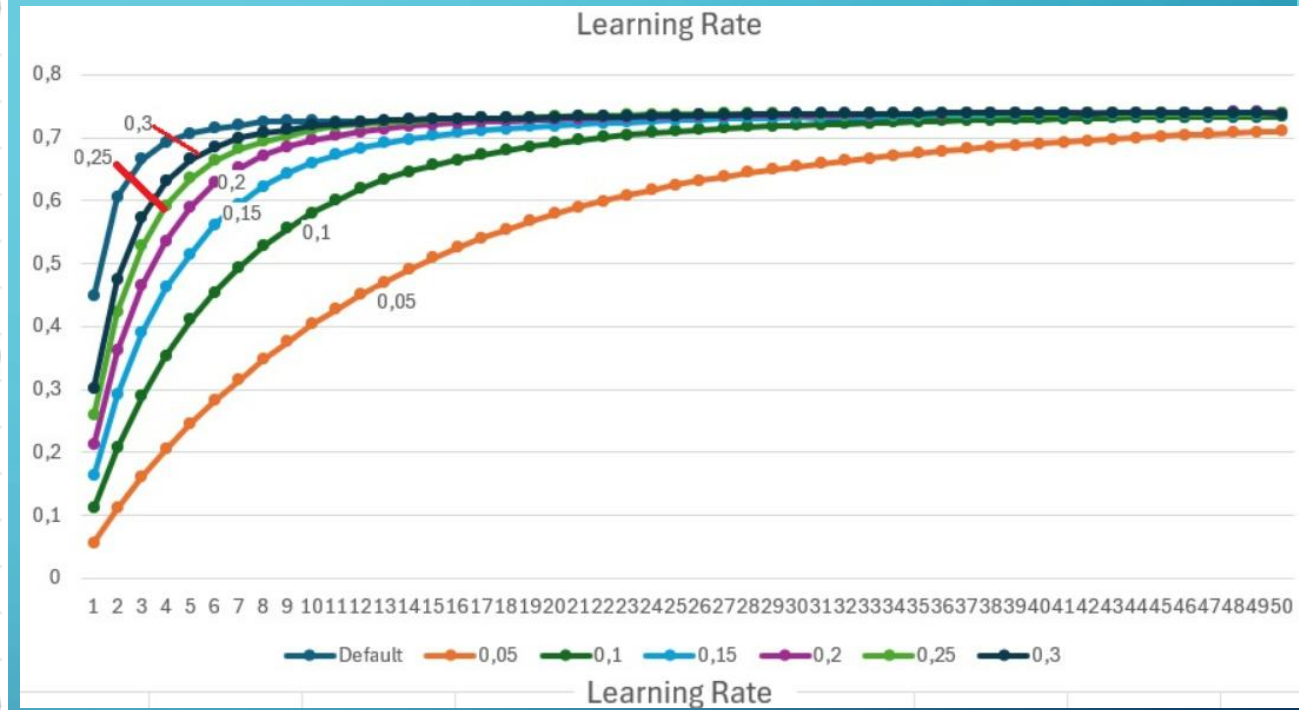
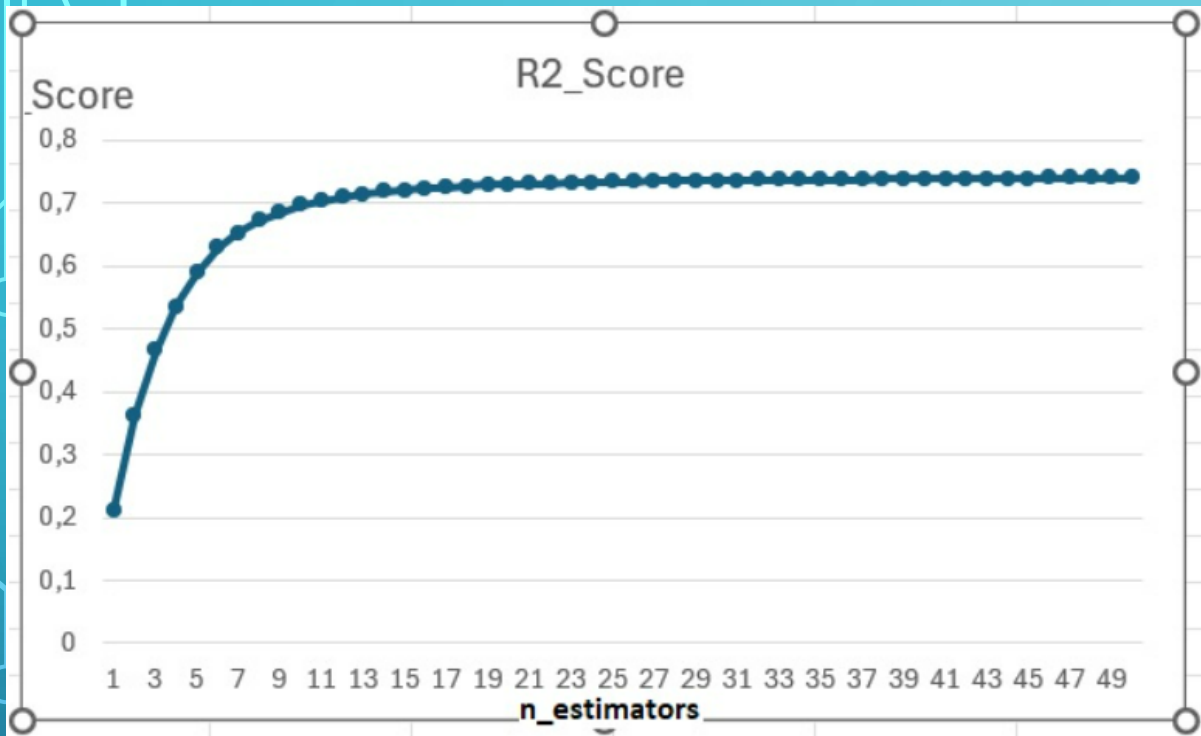
One way audio



Modelos testeados

1. Regresión Lineal (Score 0,65)
2. DecisionTreeRegressor (Score 0,68)
3. BaggingRegressor (Score 0,68)
4. RandomForestRegressor (Score 0,73)
5. ExtraTreesRegressor (Score 0,729)
6. Xgboost (Score 0,69)
7. Lightgbm (Score 0,727)
8. Catboost (Score 0,74) << seleccionado

Hiper parámetros tunning



MODELO GANADOR CATBOOST Hiperparámetros
(Learning Rate = 0,2 & n_estimators = 50)

Explicabilidad del modelo

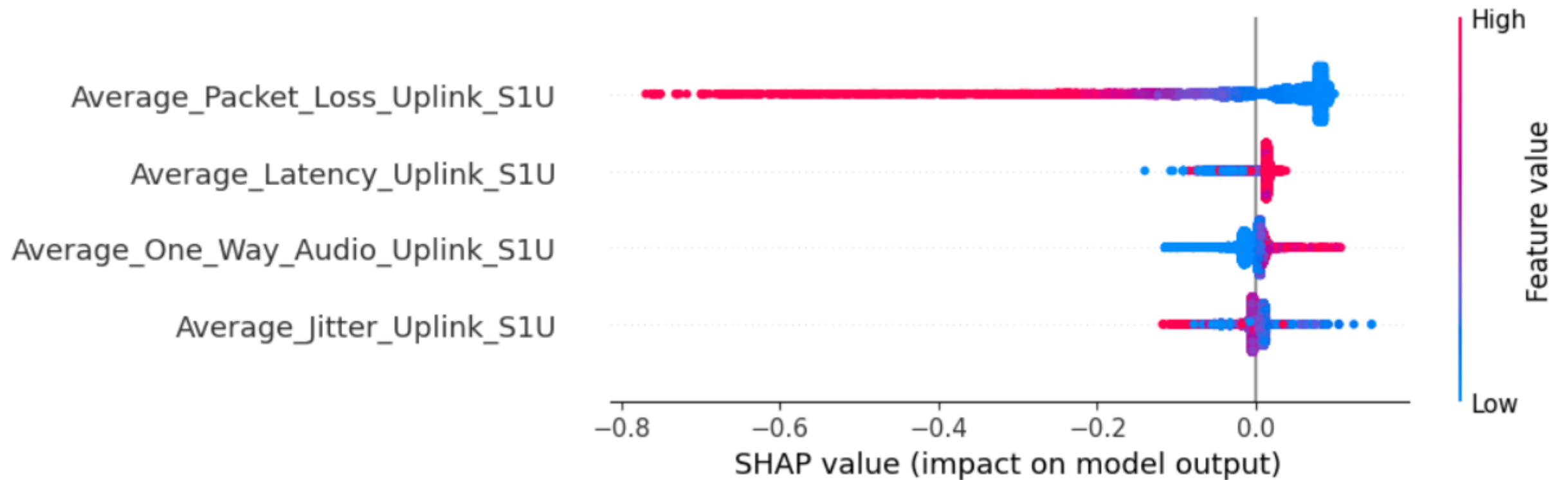


Gráfico final de la predicción

