Escuela Politécnica Nacional

Redes Neuronales

Tarea 6: Dataset Carsmall

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En este apartado analizaremos mediante diferentes algoritmos el Dataset carsmall, el cual comprende un problema de regresión.

DT = Decision Tree

RF = Random Forest

DNN= Deep Neuronal Network

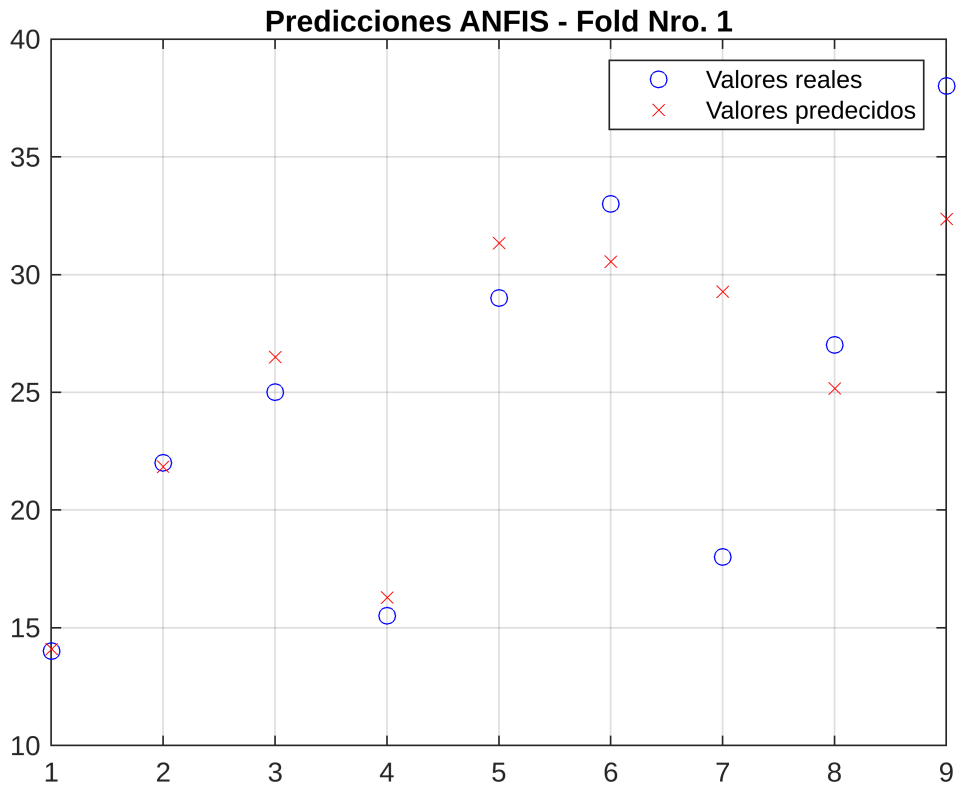
LDA = Linear Discriminant Analysis

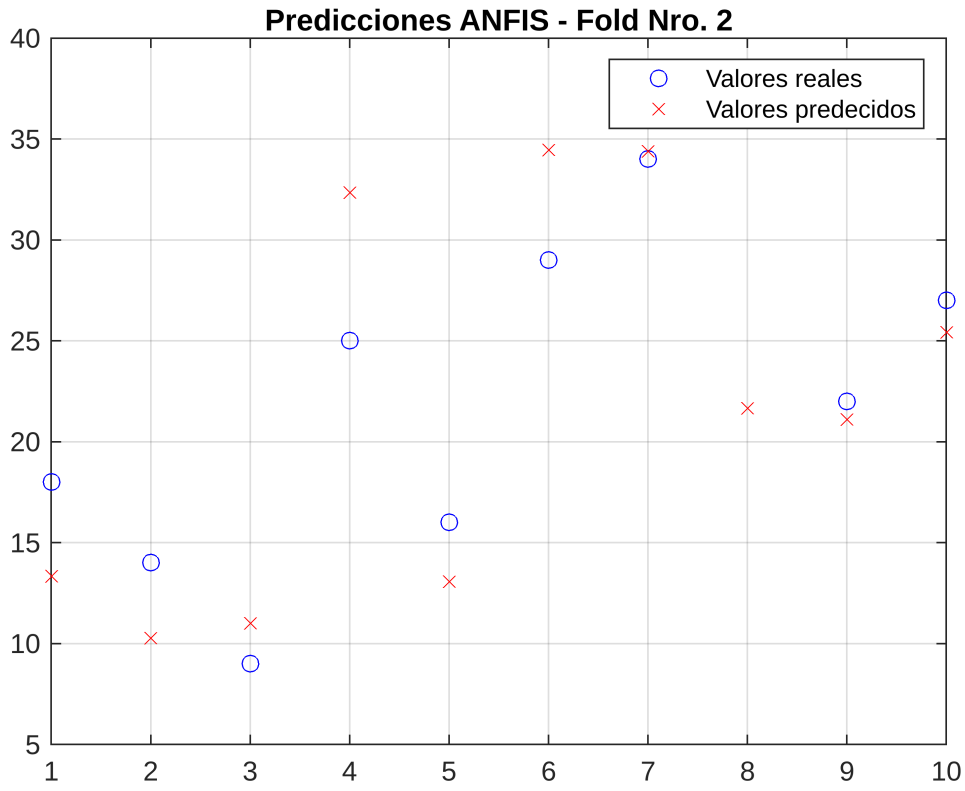
ANFIS = Adaptive Neuro Fuzzy Inference System

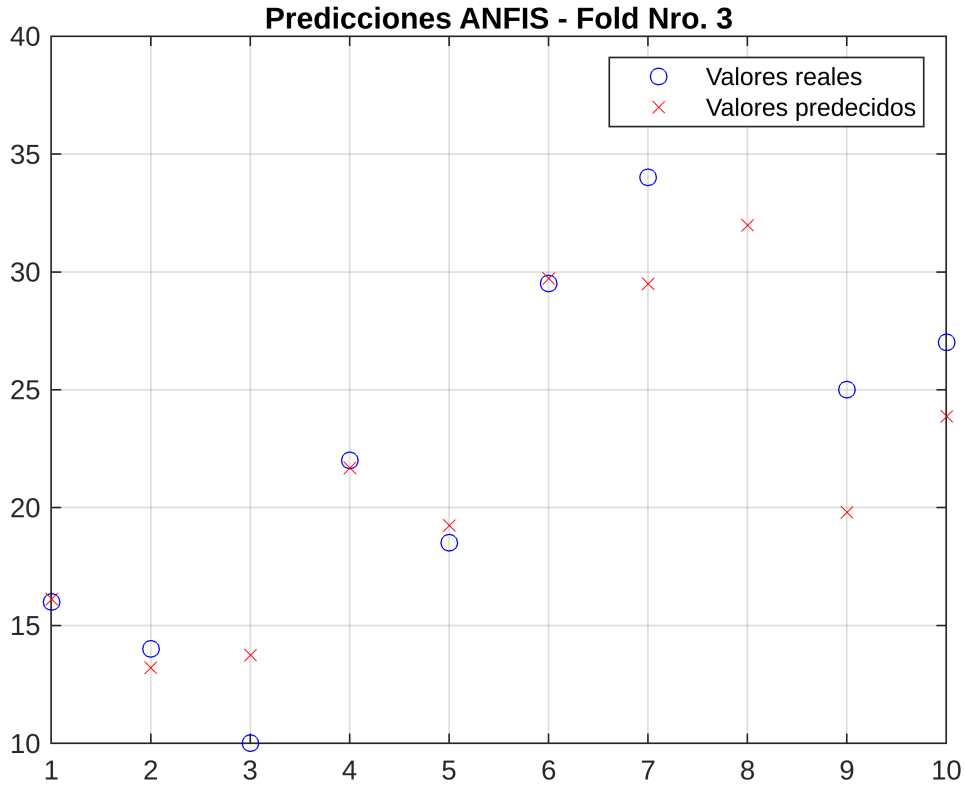
```
% Dataset Carsmall
tic
clc;
clear;
rng(0);
warning("off","all");

% Carga y limpieza de datos
load carsmall;

Datos = [Weight, Cylinders, Horsepower, MPG];

% Si se desea usar todos los campos, descomentar esta línea
% Observación: El modelo no mejora después de incorporar el
% resto de campos

%Datos = table(Acceleration, Cylinders, Displacement, Horsepower, ...
    %double(categorical(string(Mfg))), ...
    %double(categorical(string(Model))), ...
    %Model_Year, ...
    %double(categorical(string(Origin))), ...
    %Weight, MPG);

Datos = rmmissing(Datos);

X = Datos(:, 1:3);
Y = Datos(:, 4);
```

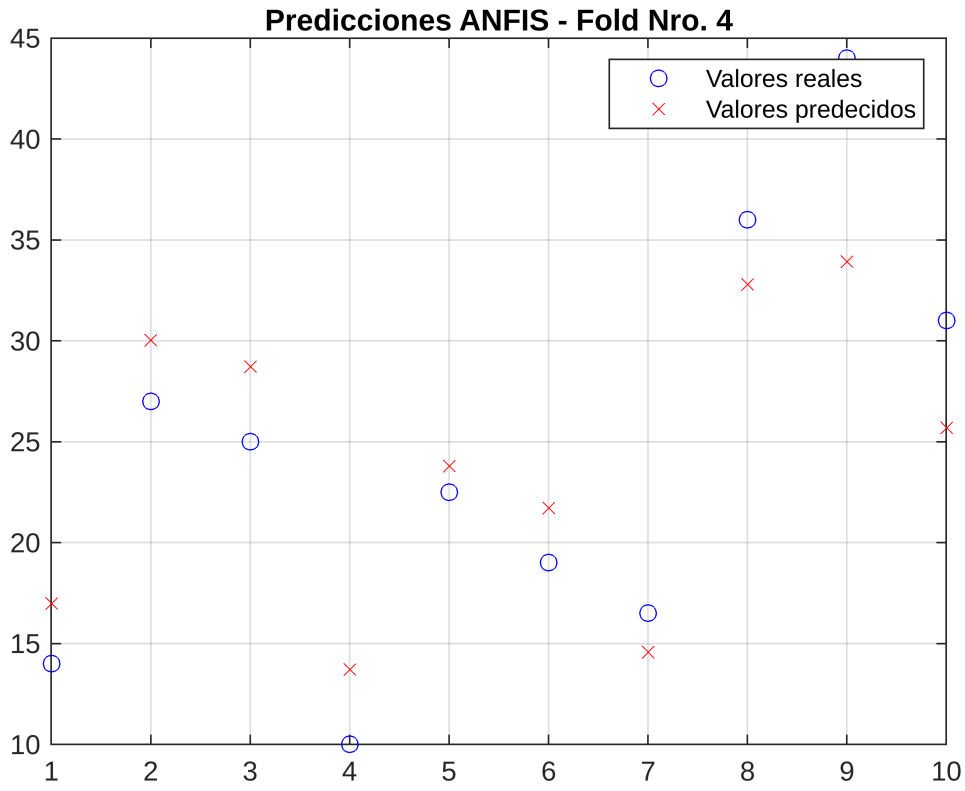
```
% Método 10-folding
CVO = cvpartition(Y,"k",10);
num_pruebas = CVO.NumTestSets;

for i = 1:num_pruebas
    trIdx = CVO.training(i);
    teIdx = CVO.test(i);

    % Decision Tree
    ctree = fitrtree(X(trIdx,:), Y(trIdx,:), "MinLeafSize", 30);
    Ypred_dt = predict(ctree, X(teIdx,:));
    Met_dt(1,i) = mse(Y(teIdx,:), Ypred_dt);
    Met_dt(2,i) = power(corr2(Y(teIdx,:), Ypred_dt),2);

    % Random Forest
    rf = TreeBagger(200, X(trIdx,:), Y(trIdx,:), "Method", "regression",
"OOBPrediction", "On", "MinLeafSize", 30);
    Ypred_rf = predict(rf, X(teIdx,:));
    Met_rf(1,i) = mse(Y(teIdx,:), Ypred_rf);
    Met_rf(2,i) = power(corr2(Y(teIdx,:), Ypred_rf),2);

    % Deep Neuronal Network
    dnn = fitrnet(X(trIdx,:), Y(trIdx,:), ...
          "LayerSizes", [32 32], ...
          "Activations","relu", ...
          "Lambda", 0.004, ...
          "IterationLimit", 1000, ...
          "Standardize", true);
     Ypred_dnn = predict(dnn, X(teIdx,:));
     Met_dnn(1,i) = mse(Y(teIdx,:), Ypred_dnn);
     Met_dnn(2,i) = power(corr2(Y(teIdx,:), Ypred_dnn),2);

    % ANFIS
    opt = anfisOptions;
    opt.InitialFIS = 3;
    opt.EpochNumber = 100;
    opt.OptimizationMethod = 0;
    opt.DisplayANFISInformation = 0;
    opt.DisplayErrorValues = 0;
    opt.DisplayStepSize = 0;
    opt.DisplayFinalResults = 0;

    anfis_model = anfis([X(trIdx,:) Y(trIdx,:)], opt);
    Ypred_anfis = evalfis(anfis_model, X(teIdx,:));
    Met_anfis(1,i) = mse(Y(teIdx,:), Ypred_anfis);
    Met_anfis(2,i) = power(corr2(Y(teIdx,:), Ypred_anfis),2);

    % Gráfica de predicciones ANFIS
    figure;
```

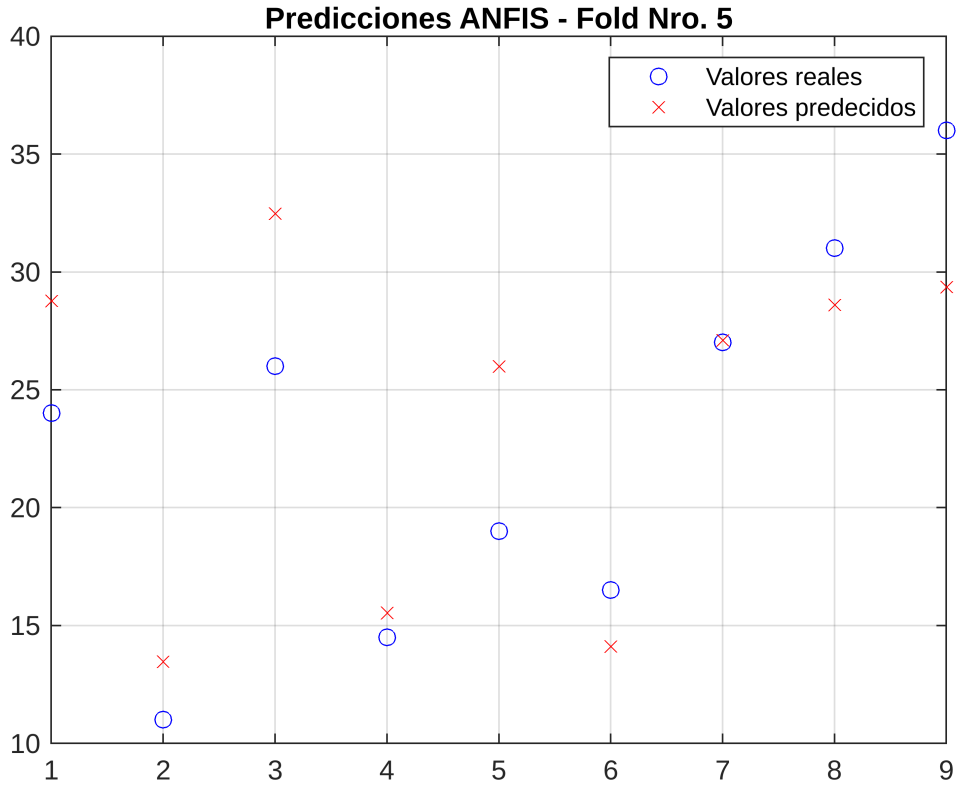
```
    plot(Y(teIdx,:),"ob");
    hold on
    plot(Ypred_anfis,"xr")
    grid on;
    title(strcat("Predicciones ANFIS - Fold Nro. ", string(i)));
    legend("Valores reales","Valores predecidos");
    ax = gca;
    ax.XTick = unique(round(ax.XTick));
    hold off;
end
```

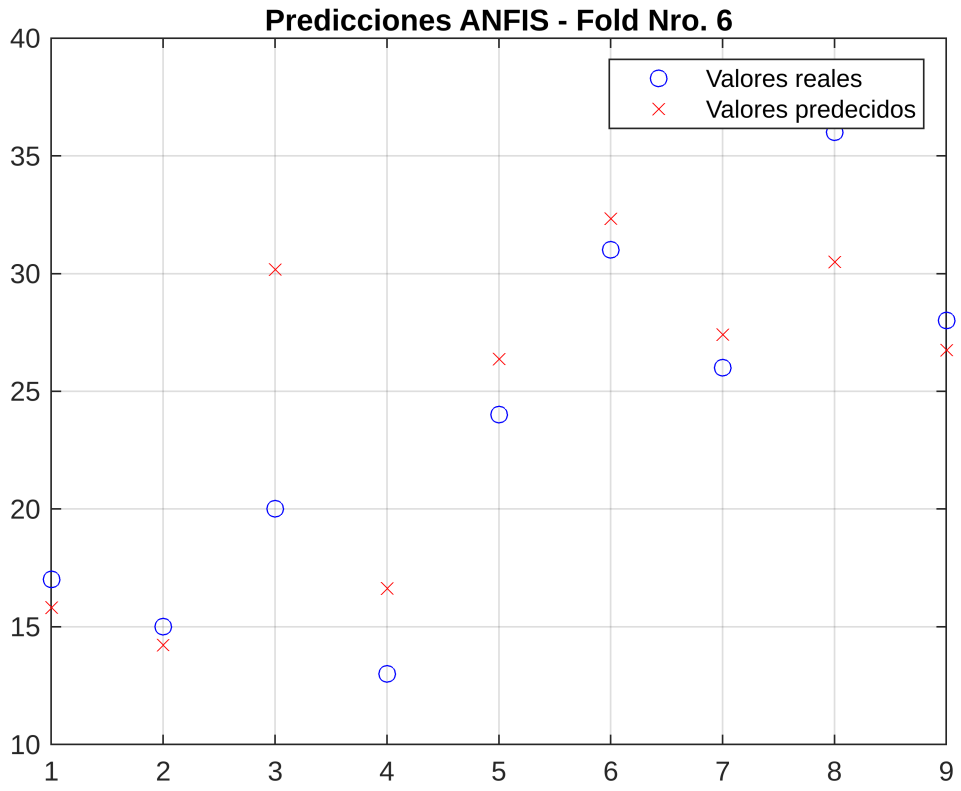


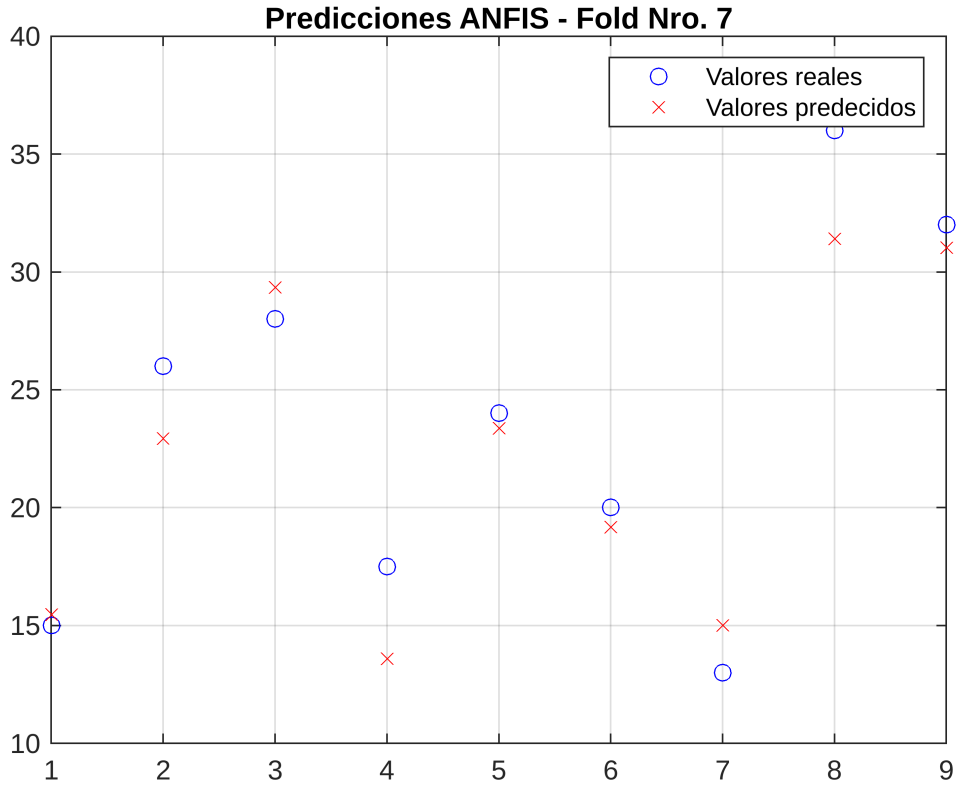

Predicciones ANFIS - Fold Nro. 2
Valores reales
Valores predecidos
40
35
30
25
20
15
10
5
1
2
3
4
5
6
7
8
9
10

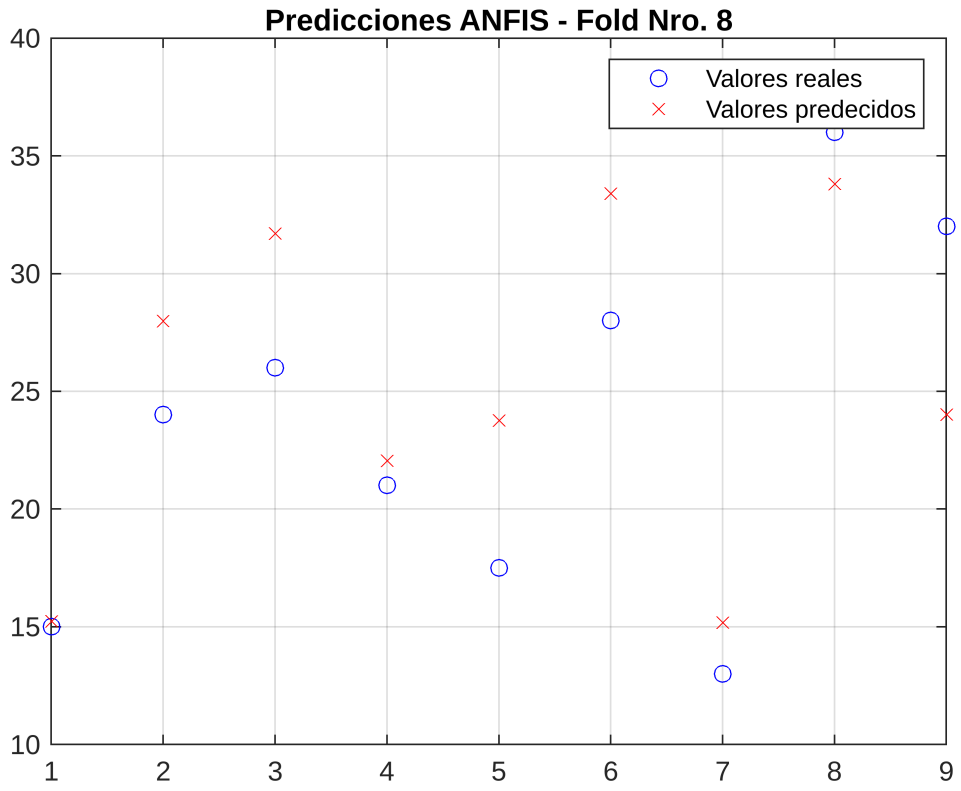

Predicciones ANFIS - Fold Nro. 3
Valores reales
Valores predecidos
40
35
30
25
20
15
10
1
2
3
4
5
6
7
8
9
10

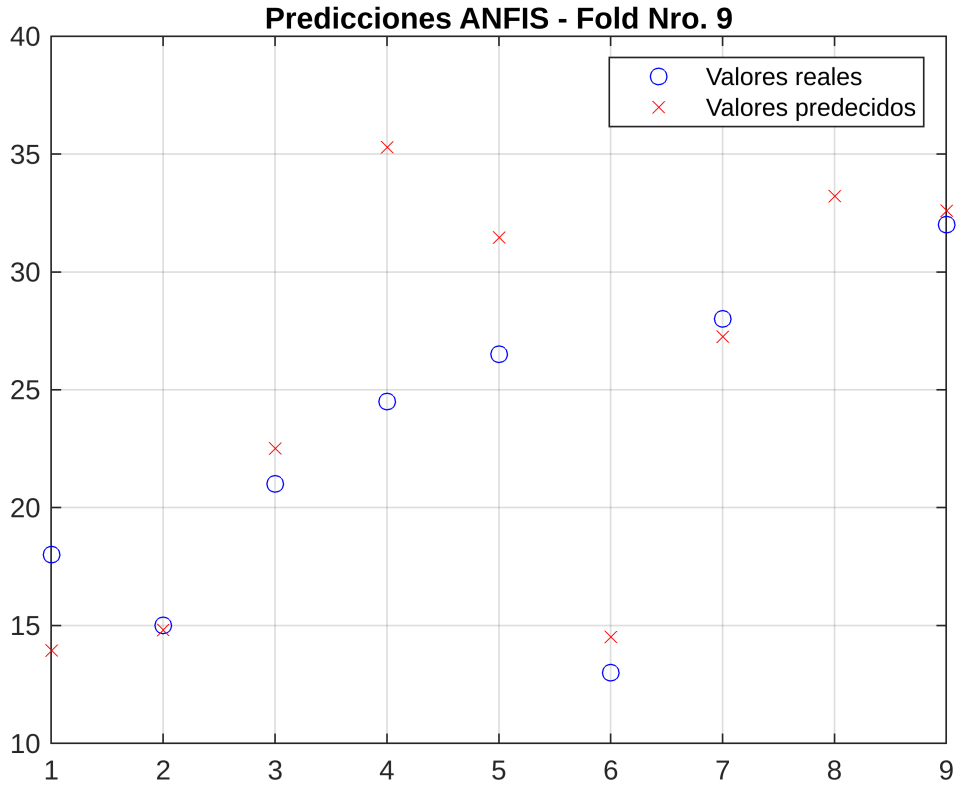

Predicciones ANFIS - Fold Nro. 4
Valores reales
Valores predecidos
45
40
35
30
25
20
15
10
1
2
3
4
5
6
7
8
9
10

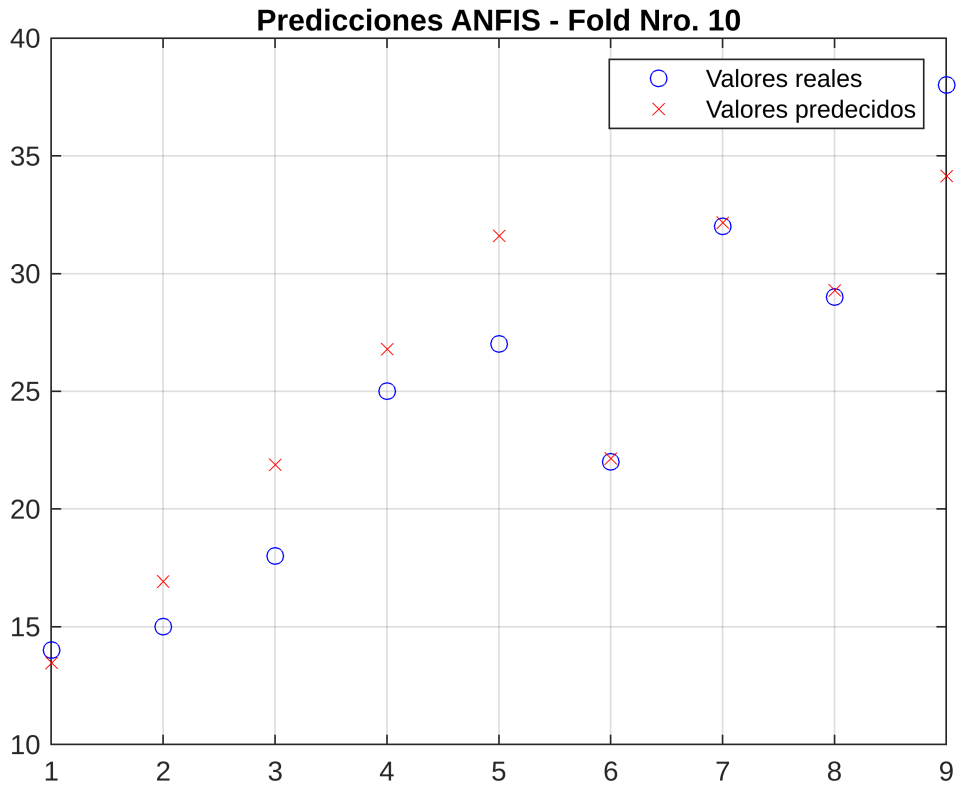

Predicciones ANFIS - Fold Nro. 5
Valores reales
Valores predecidos
40
35
30
25
20
15
10
1
2
3
4
5
6
7
8
9


Predicciones ANFIS - Fold Nro. 6
Valores reales
Valores predecidos
40
35
30
25
20
15
10
1
2
3
4
5
6
7
8
9


Predicciones ANFIS - Fold Nro. 7
Valores reales
Valores predecidos
40
35
30
25
20
15
10
1
2
3
4
5
6
7
8
9


Predicciones ANFIS - Fold Nro. 8
Valores reales
Valores predecidos
40
35
30
25
20
15
10
1
2
3
4
5
6
7
8
9


Predicciones ANFIS - Fold Nro. 9
Valores reales
Valores predecidos
40
35
30
25
20
15
10
1
2
3
4
5
6
7
8
9




```
% Obtención de métricas finales
Metricas_dt = mean(Met_dt,2)
```

```
Metricas_dt = 2×1
   28.3278
    0.5917
```

```
Metricas_rf = mean(Met_rf,2)
```

```
Metricas_rf = 2×1
   19.7890
    0.7541
```

```
Metricas_dnn = mean(Met_dnn,2)
```

```
Metricas_dnn = 2×1
   30.9922
    0.6218
```

```
Metricas_anfis = mean(Met_anfis,2)
```

```
Metricas_anfis = 2×1
   18.1389
    0.7628
```

```
toc
```

```
Elapsed time is 13.648986 seconds.
```

Conclusión

Se puede concluir, de manera general, que para todos los casos las métricas de menor valor corresponden a las obtenidas a través del árbol de decisión individual (DT).

En lo referente al problema de regresión, las mejores métricas fueron obtenidas con los algoritmos Random Forest (RF) y ANFIS, seguido de la red neuronal profunda (DNN) y finalmente del árbol de decisión individual (DT).