Train In Data

Mean or Median Imputation

Mean / Median imputation: definition

- Mean / median imputation consists of replacing all occurrences of missing values (NA) within a variable by the mean or median

- Suitable numerical variables

Mean / Median imputation: example

Price
100
90
50
40
20
100
60
120
200

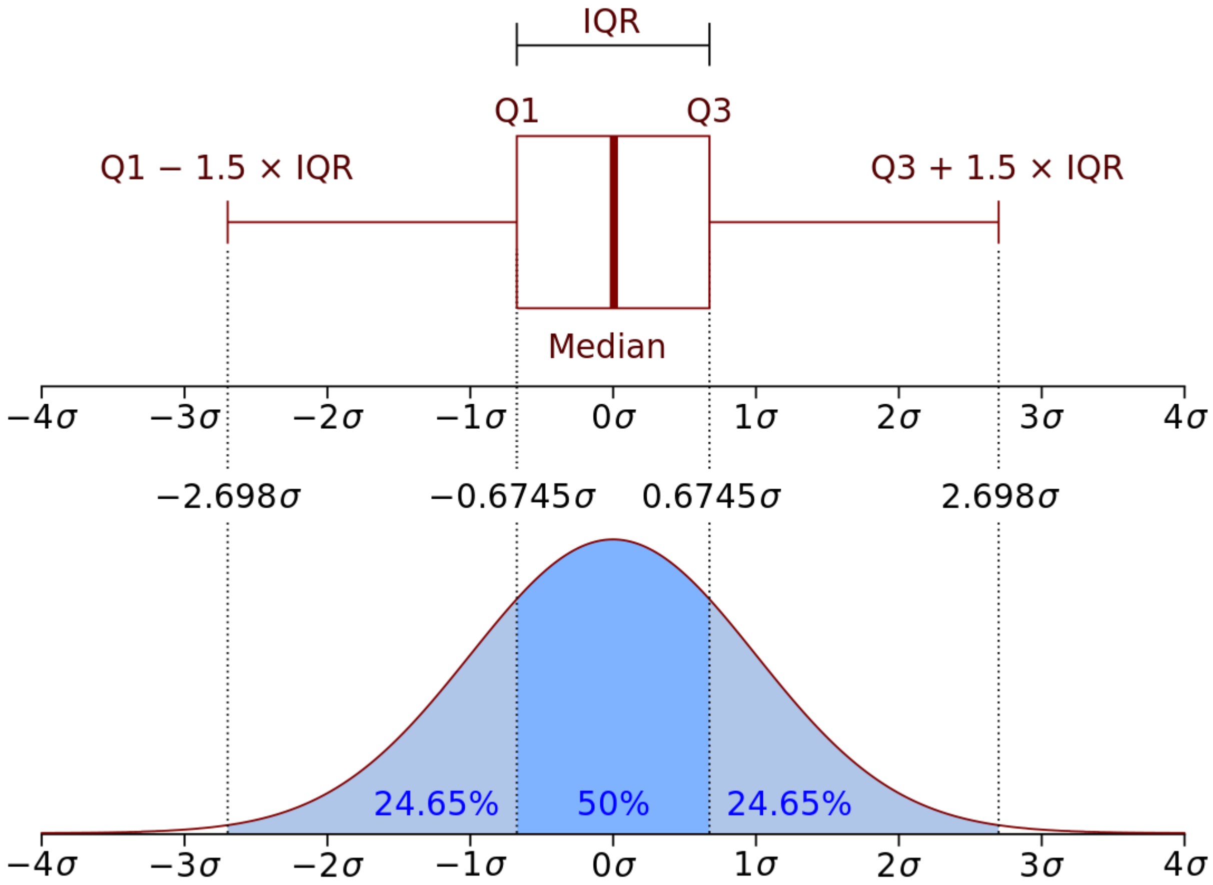
Mean = 86.66

Median = 90

→

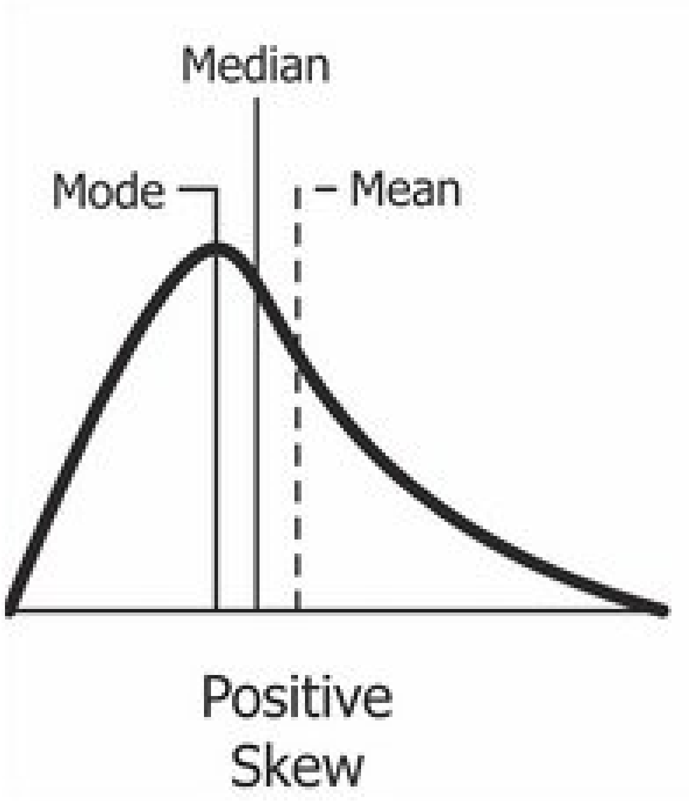
Price
100
90
50
40
20
100
86.66
60
120
86.66
200

Mean or Median imputation



- If the variable is normally distributed the mean and median are approximately the same

Mean or Median imputation



- If the variable is skewed, the median is a better representation

Mean / Median imputation: Assumptions

- Data is missing at random
- The missing observations, most likely look like the majority of the observations in the variable (aka, the mean / median)

Mean / Median imputation: Advantages

- Easy to implement
- Fast way of obtaining complete datasets

Mean / Median imputation: Limitations

- Distortion of the original variable distribution
- Distortion of the original variance
- Distortion of the covariance with the remaining variables of the dataset
- **The higher the percentage of NA, the higher the distortions**

When to use Mean / Median Imputation

- Data is missing completely at random
- No more than 5% of the variable contains missing data

When to use Mean / Median Imputation

Typically, mean / median imputation is done together with adding a binary "missing indicator" variable to capture those observations where the data was missing (see lecture "Missing Indicator"), thus covering 2 angles:

if the data was missing completely at random, this would be captured by the mean /median imputation, and if it wasn't this would be captured by the additional "missing indicator" variable. Both methods are extremely straight forward to implement, and therefore are a top choice in data science competitions.

Accompanying Jupyter Notebook

- Read the accompanying Jupyter Notebook
  - Mean / median imputation with pandas
  - Effect of the imputation on:
    - Variable distribution - variance
    - Interaction with other variables - covariance
    - Outliers

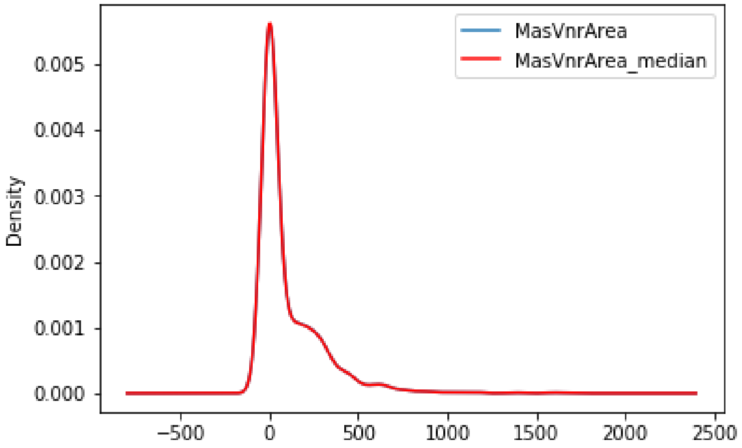
Mean / Median Imputation

- The mean or median value should be calculated only in the train set and used to replace NA in both train and test sets.

- To avoid over-fitting

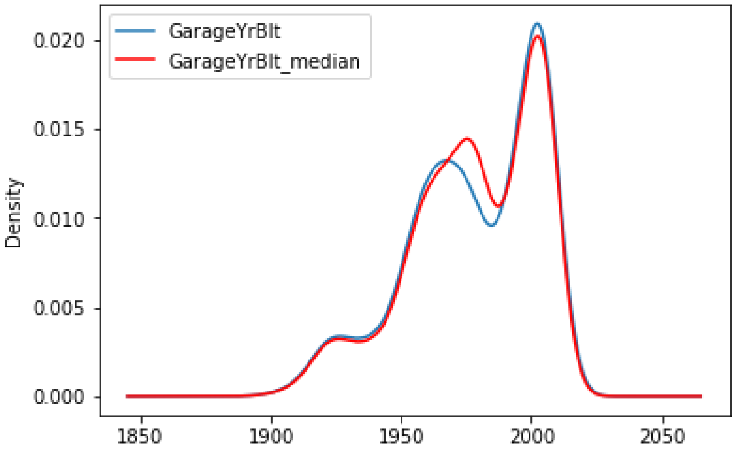
Mean / Median Imputation effects

MasVnrArea 0.5% missing obs



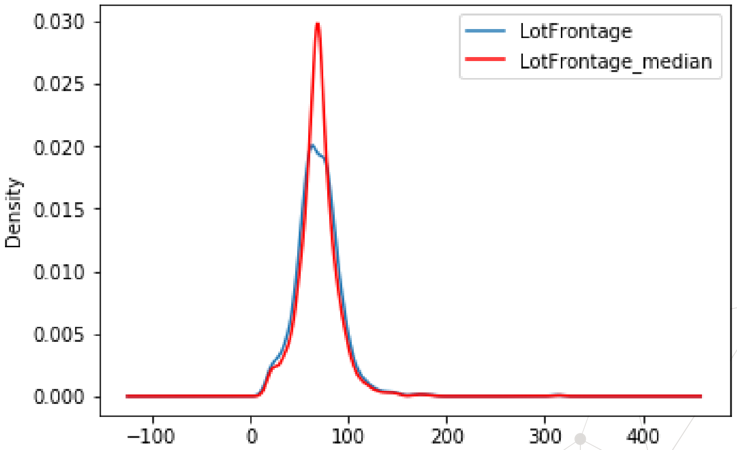
Variance: 32983
Variance after imputation: 32874

GarageYrBlt 5.5% missing obs



Variance: 624
Variance after imputation: 591

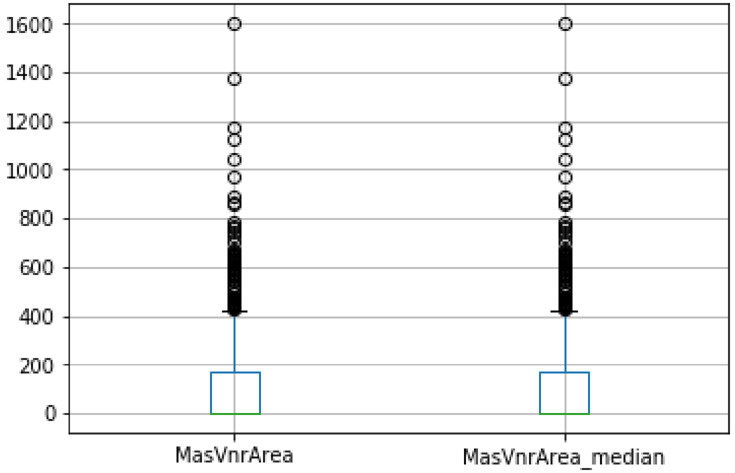
LotFrontage 17% missing obs



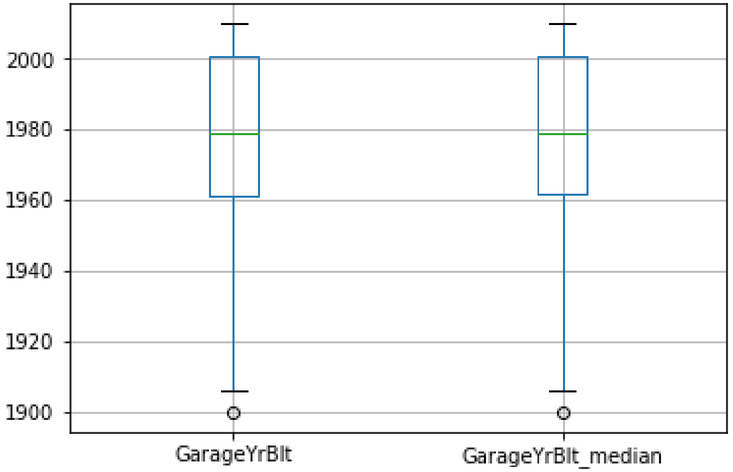
Variance: 532
Variance after imputation: 434

Mean / Median Imputation effects

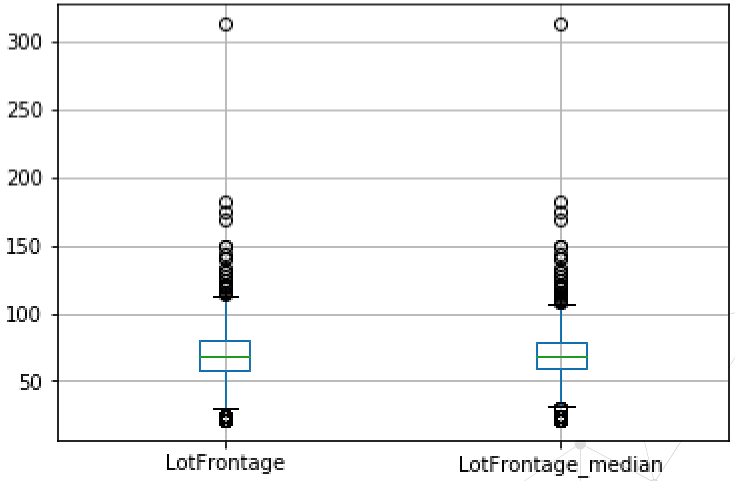
MasVnrArea 0.5% missing obs



GarageYrBlt 5.5% missing obs

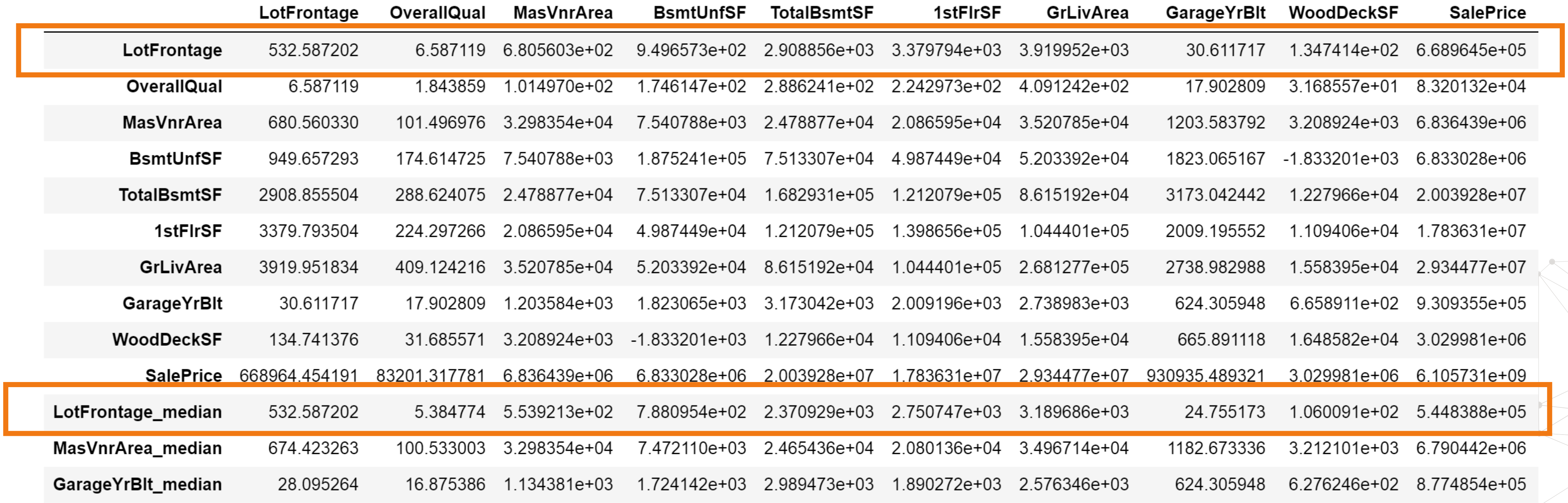


LotFrontage 17% missing obs



More apparent outliers at both ends of the distribution

Mean / Median Imputation effects



	LotFrontage	OverallQual	MasVnrArea	BsmtUnfSF	TotalBsmtSF	1stFlrSF	GrLivArea	GarageYrBlt	WoodDeckSF	SalePrice
LotFrontage	532.587202	6.587119	6.805603e+02	9.496573e+02	2.908856e+03	3.379794e+03	3.919952e+03	30.611717	1.347414e+02	6.689645e+05
OverallQual	6.587119	1.843859	1.014970e+02	1.746147e+02	2.886241e+02	2.242973e+02	4.091242e+02	17.902809	3.168557e+01	8.320132e+04
MasVnrArea	680.560330	101.496976	3.298354e+04	7.540788e+03	2.478877e+04	2.086595e+04	3.520785e+04	1203.583792	3.208924e+03	6.836439e+06
BsmtUnfSF	949.657293	174.614725	7.540788e+03	1.875241e+05	7.513307e+04	4.987449e+04	5.203392e+04	1823.065167	-1.833201e+03	6.833028e+06
TotalBsmtSF	2908.855504	288.624075	2.478877e+04	7.513307e+04	1.682931e+05	1.212079e+05	8.615192e+04	3173.042442	1.227966e+04	2.003928e+07
1stFlrSF	3379.793504	224.297266	2.086595e+04	4.987449e+04	1.212079e+05	1.398656e+05	1.044401e+05	2009.195552	1.109406e+04	1.783631e+07
GrLivArea	3919.951834	409.124216	3.520785e+04	5.203392e+04	8.615192e+04	1.044401e+05	2.681277e+05	2738.982988	1.558395e+04	2.934477e+07
GarageYrBlt	30.611717	17.902809	1.203584e+03	1.823065e+03	3.173042e+03	2.009196e+03	2.738983e+03	624.305948	6.658911e+02	9.309355e+05
WoodDeckSF	134.741376	31.685571	3.208924e+03	-1.833201e+03	1.227966e+04	1.109406e+04	1.558395e+04	665.891118	1.648582e+04	3.029981e+06
SalePrice	668964.454191	83201.317781	6.836439e+06	6.833028e+06	2.003928e+07	1.783631e+07	2.934477e+07	930935.489321	3.029981e+06	6.105731e+09
LotFrontage_median	532.587202	5.384774	5.539213e+02	7.880954e+02	2.370929e+03	2.750747e+03	3.189686e+03	24.755173	1.060091e+02	5.448388e+05
MasVnrArea_median	674.423263	100.533003	3.298354e+04	7.472110e+03	2.465436e+04	2.080136e+04	3.496714e+04	1182.673336	3.212101e+03	6.790442e+06
GarageYrBlt_median	28.095264	16.875386	1.134381e+03	1.724142e+03	2.989473e+03	1.890272e+03	2.576346e+03	624.305948	6.276246e+02	8.774854e+05

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THANK YOU

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