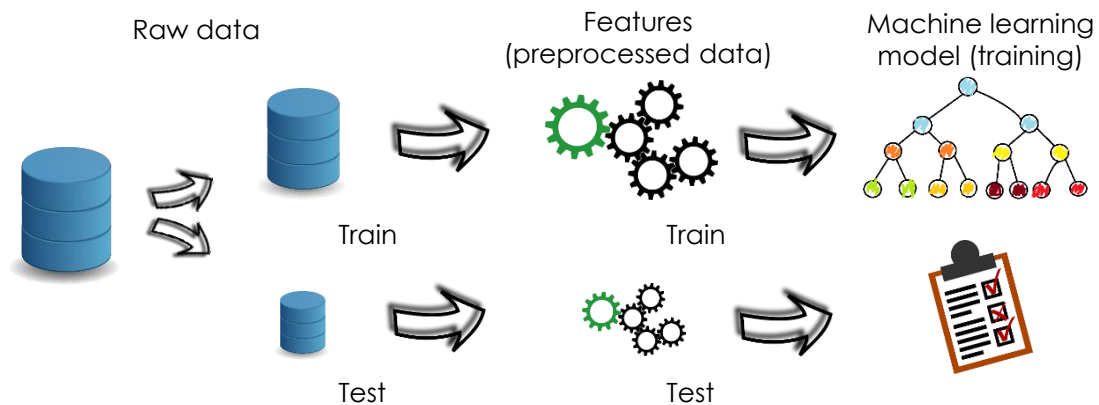
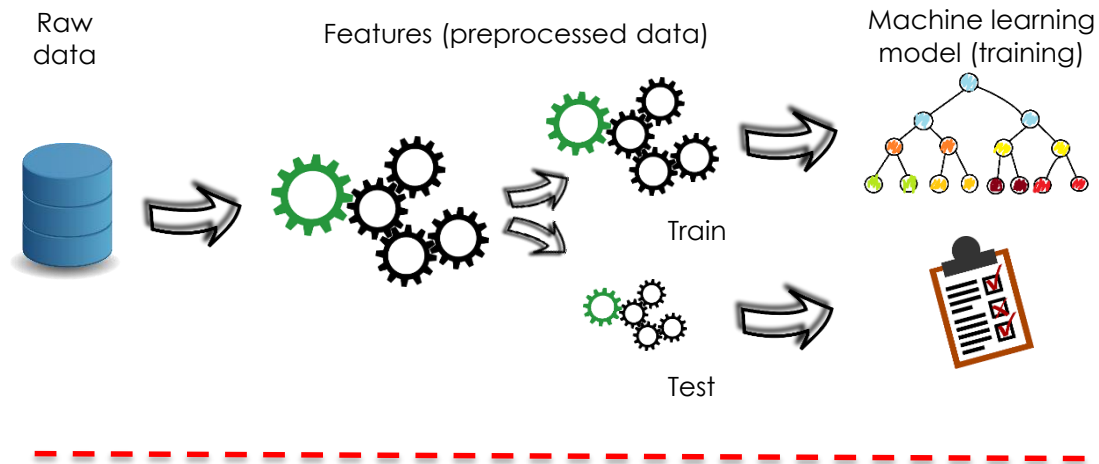


# Feature Engineering in Forecasting

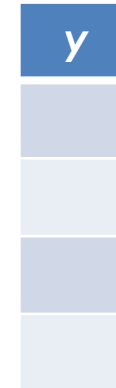
---

Considerations

# Machine learning workflow: forecasting

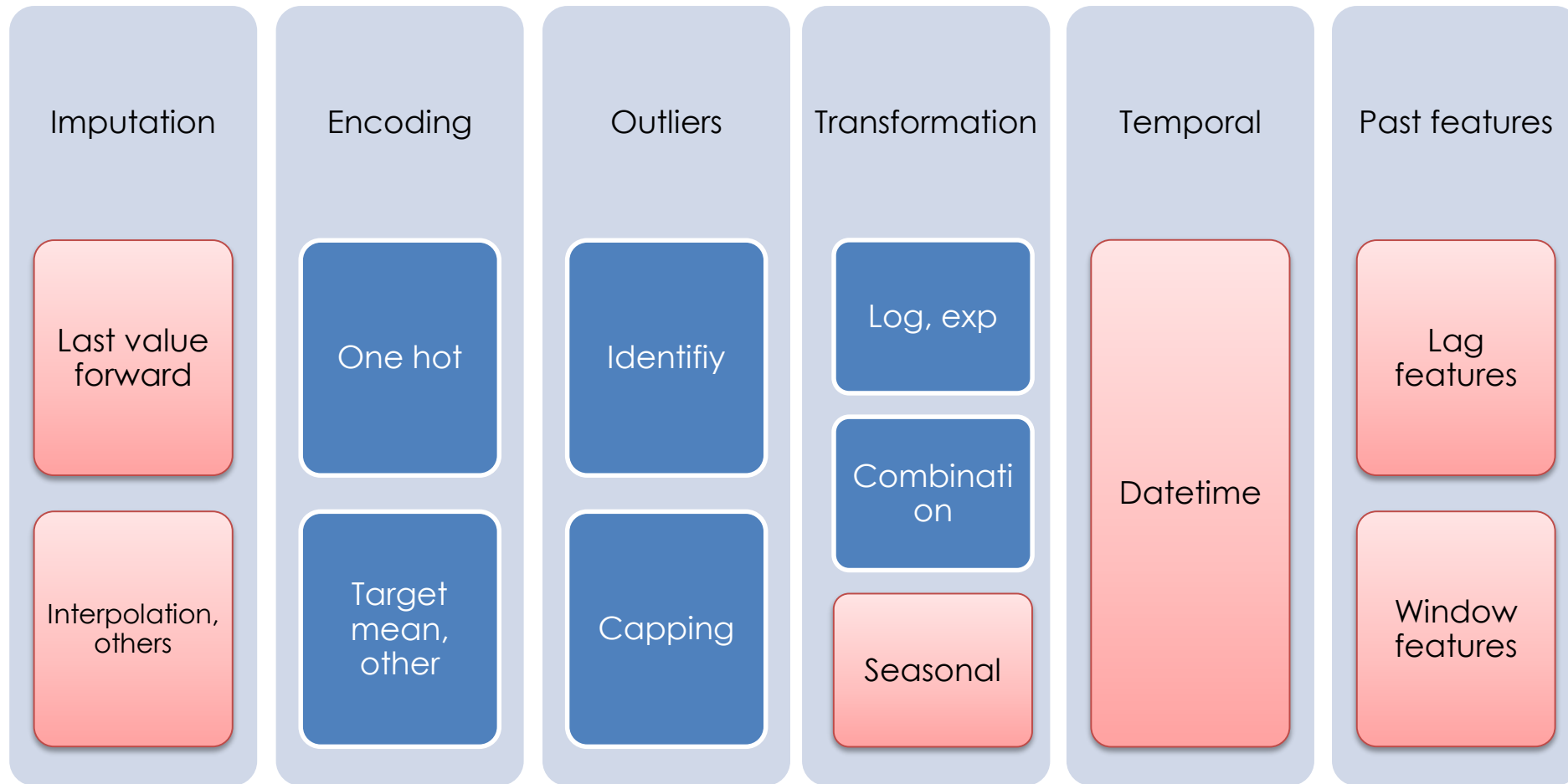


Time series data

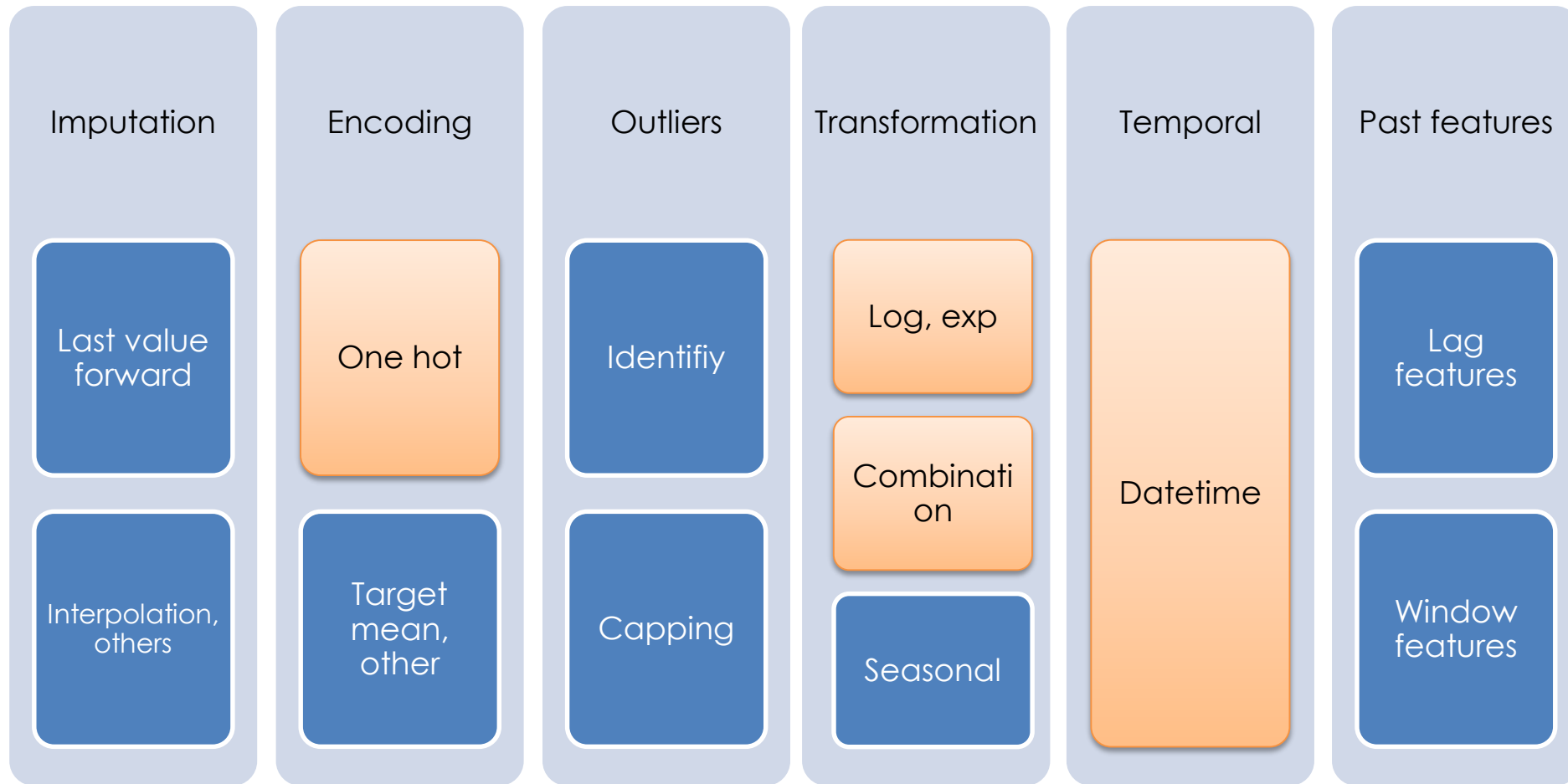


The raw data does not contain the input features.

# Feature engineering – forecasting



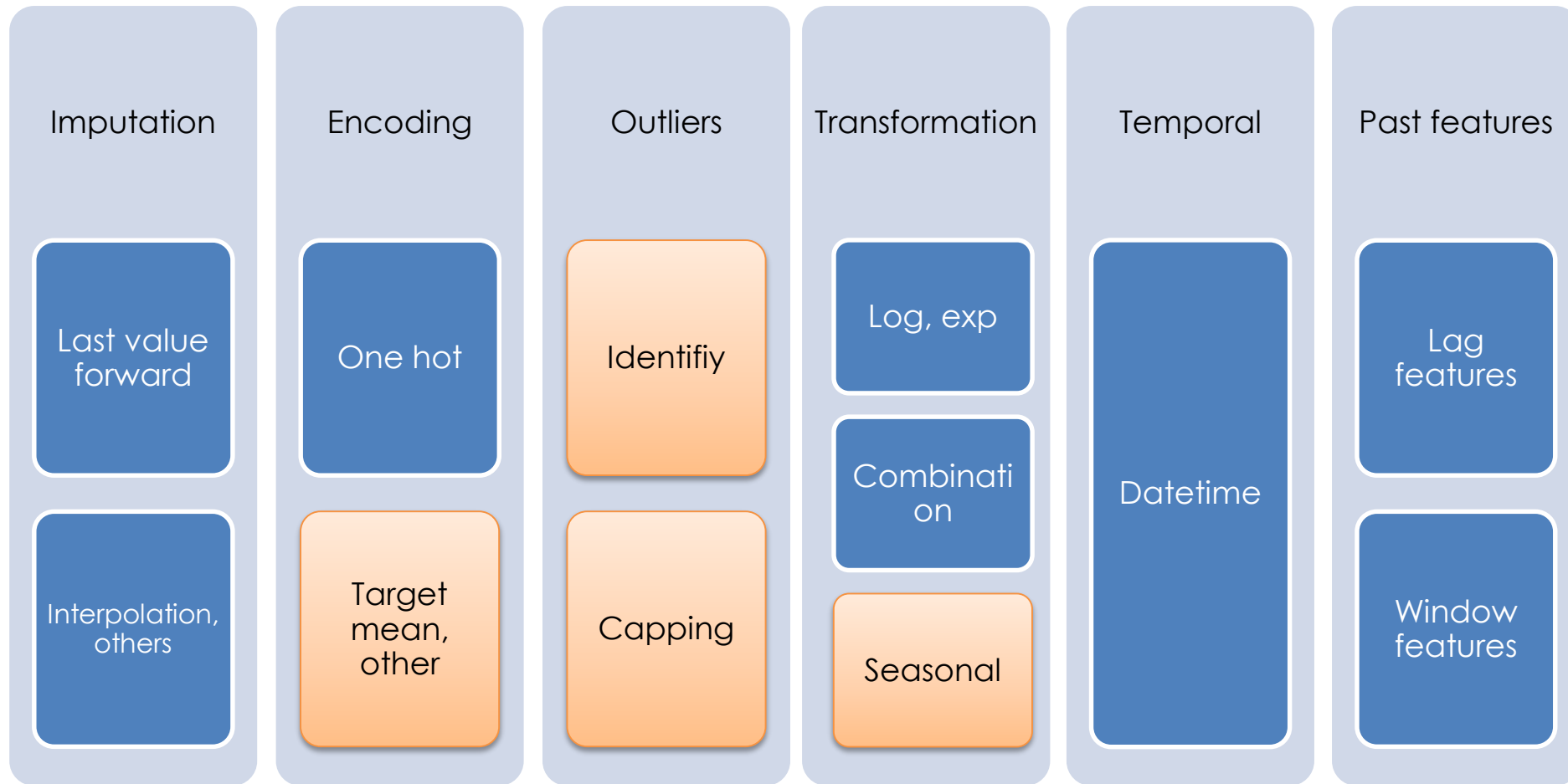
# Feature engineering – forecasting



Some transformations **do not learn** parameters.

We can split the data or not.

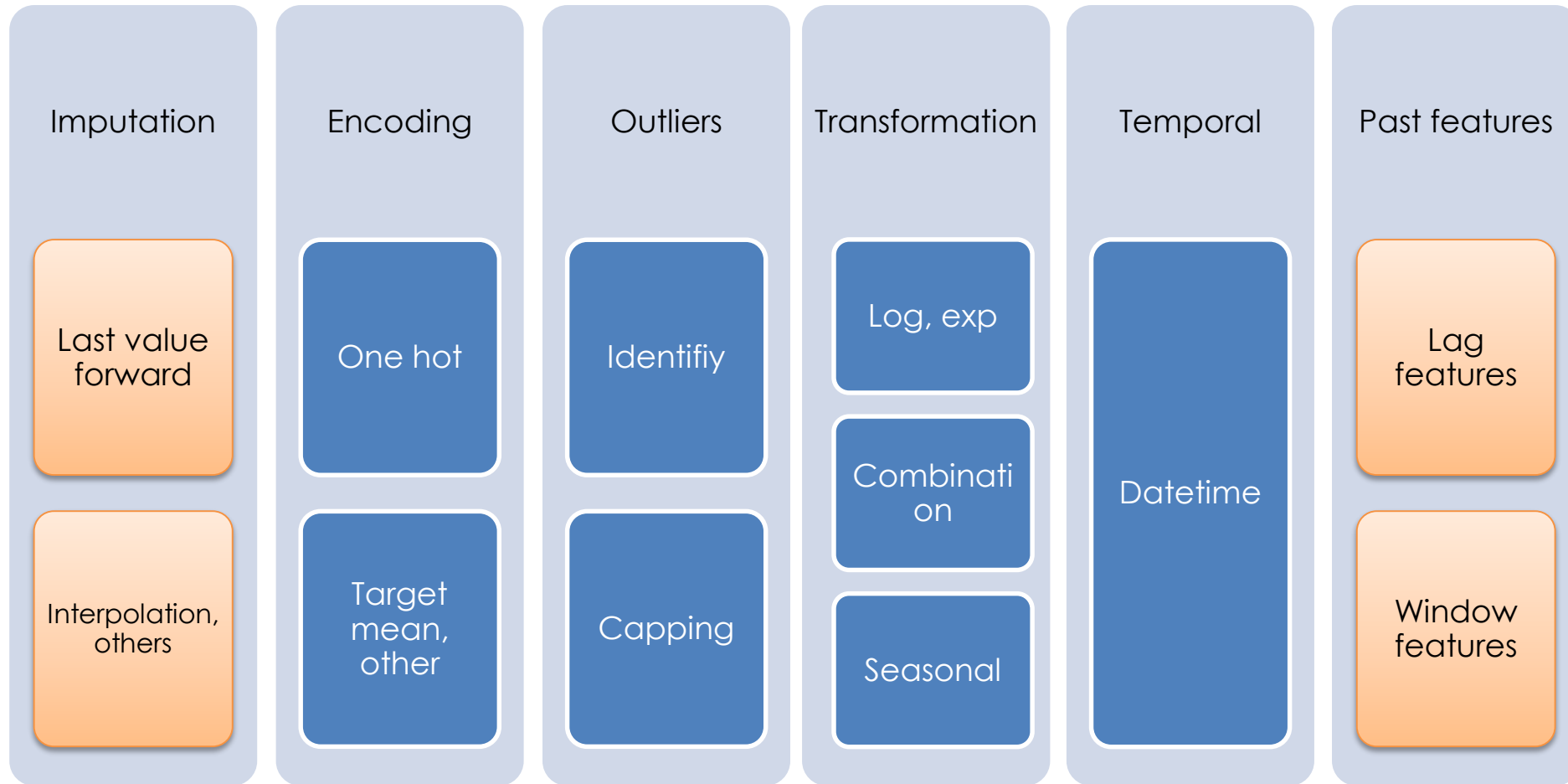
# Feature engineering – forecasting



Some transformations **do learn** parameters.

We should split the raw.

# Feature engineering – forecasting



Some transformations **rely on past values**.

We can't split the raw.

# Train test split



Raw data



Train and Test

We separate the original dataset into a train and a test set.

# Lag features – rely on past values

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Data set

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Train and Test



NA	t1	t2	t3	t4	t5	NA	t7	t8
NA	NA	t1	t2	t3	t4	NA	NA	t7
NA	NA	NA	t1	t2	t3	NA	NA	NA

T-1

T-2

T-3

Features

If we extract the features after the separation...



# Lag features => bring value forward

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Data set

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Train and Test



NA	t1	t2	t3	t4	t5	t6	t7	t8
NA	NA	t1	t2	t3	t4	t5	t6	t7
NA	NA	NA	t1	t2	t3	t4	t5	t6

T-1

T-2

T-3

Features

When actually we know the data...

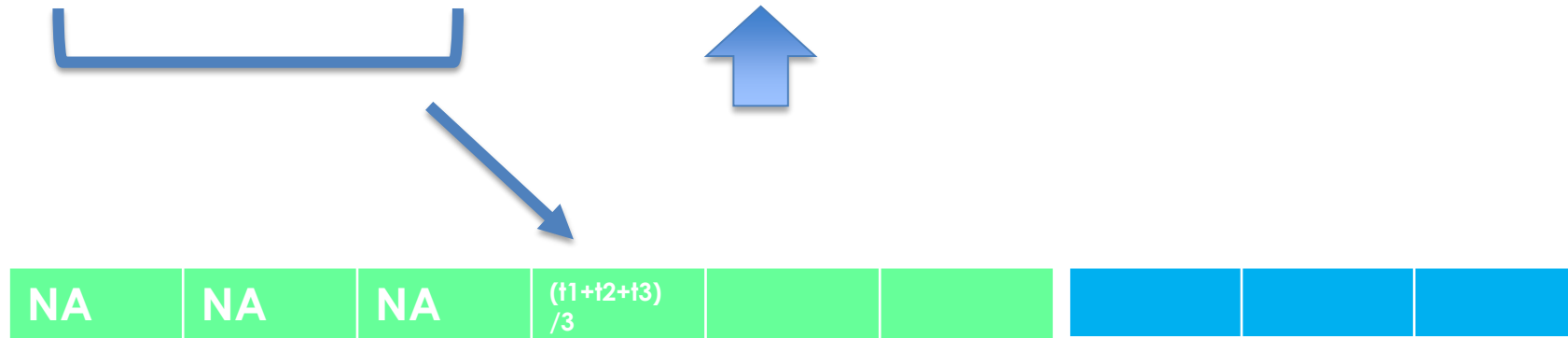
# Window features – rely on past values



Data set



Train and Test



Window = 3  
Features

If we extract the features after the separation...

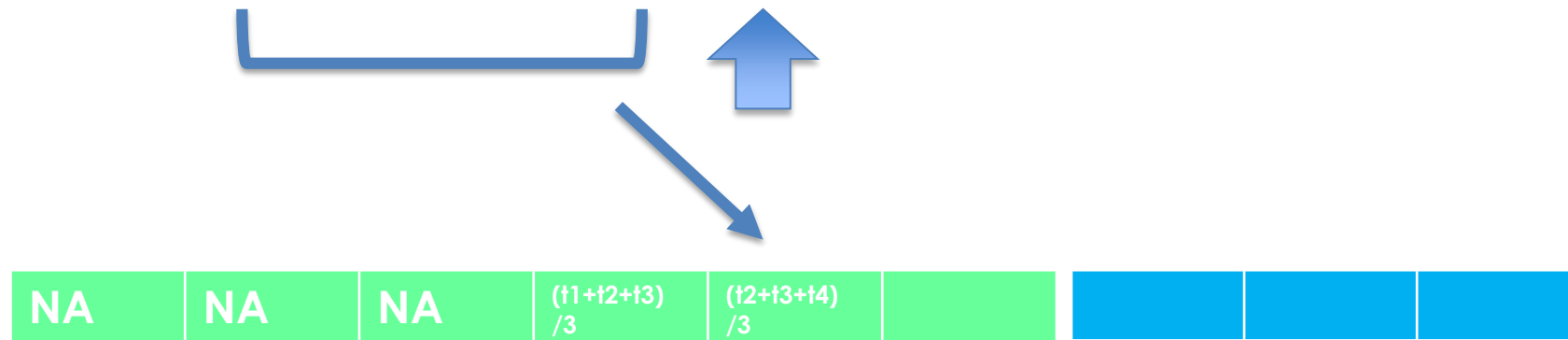
# Window features – rely on past values



Data set



Train and Test



Window = 3  
Features

If we extract the features after the separation...

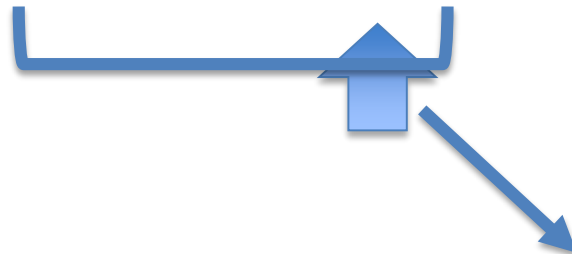
# Window features

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Data set

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Train and Test



NA	NA	NA	$\frac{(t1+t2+t3)}{3}$	$\frac{(t2+t3+t4)}{3}$	$\frac{(t3+t4+t5)}{3}$			
----	----	----	------------------------	------------------------	------------------------	--	--	--

Window = 3  
Features

If we extract the features after the separation...

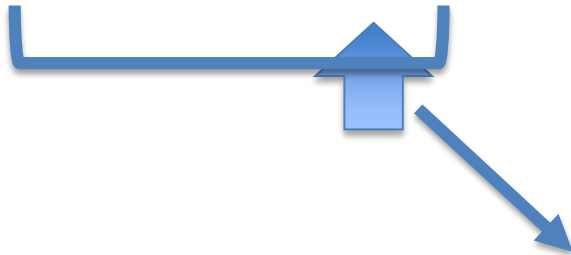
# Window features – rely on past values

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Data set

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Train and Test



NA	NA	NA	$\frac{(t1+t2+t3)}{3}$	$\frac{(t2+t3+t4)}{3}$	$\frac{(t3+t4+t5)}{3}$	NA	NA	NA
----	----	----	------------------------	------------------------	------------------------	----	----	----

Window = 3  
Features

If we extract the features after the separation...

# Window features: bring values forward

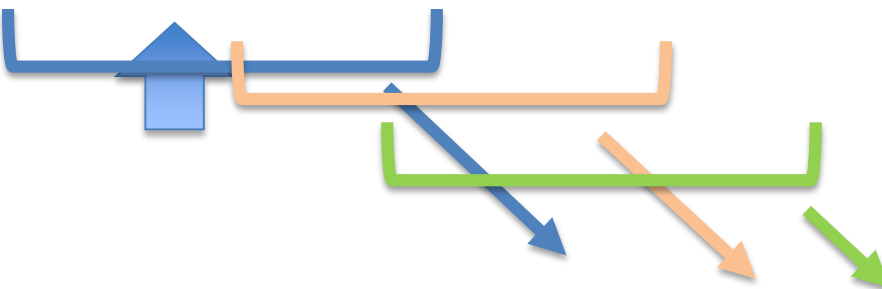
t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Data set

t1	t2	t3	t4	t5	t6	t7	t8	t9
----	----	----	----	----	----	----	----	----

Train and Test

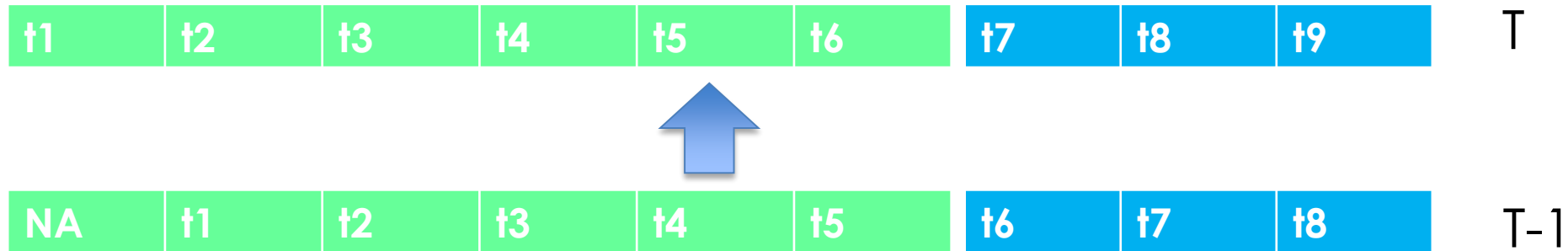
NA	NA	NA	$\frac{(t1+t2+t3)}{3}$	$\frac{(t2+t3+t4)}{3}$	$\frac{(t3+t4+t5)}{3}$	$\frac{(t4+t5+t6)}{3}$	$\frac{(t5+t6+t7)}{3}$	$\frac{(t6+t7+t8)}{3}$
----	----	----	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------



Window = 3  
Features

When actually we know the data...

# Train test split in forecasting



- Train test split in forecasting does not always work.
- Careful with the data that we use to extract the features.
- No standardized approach workflow.