All About Multi-Step Time Series

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Note: We have included a very interesting research paper to read in the Learning Resource. We have summarised from there and by other multiple resources.

The problem of predicting driver hours is a multi-step time series problem.
"Multistep-ahead prediction is the task of predicting a sequence of values in a time series. A typical approach, known as multi-stage prediction, is to apply a predictive model step-by-step and use the predicted value of the current time step to determine its value in the next time step."

After preparing a dataset for training and breaking downtime features for a time series problem. We have 4 strategies to solve a Multi-Step Time Series Problem.

1. Direct Multi-step Forecast Strategy.
2. Recursive Multi-step Forecast Strategy.
3. Direct-Recursive Hybrid Multi-step Forecast Strategies.
4. Multiple Output Forecast Strategy.

Direct Multi-Step Forecast: (No Dependence on Predicted Values, No. of models = No. of time steps to predict)

```
prediction(t+1) = model1(obs(t-1), obs(t-2), ..., obs(t-n))
prediction(t+2) = model2(obs(t-2), obs(t-3), ..., obs(t-n))
```

Recursive Multi-step Forecast: (Dependence on Predicted values and only one model required)

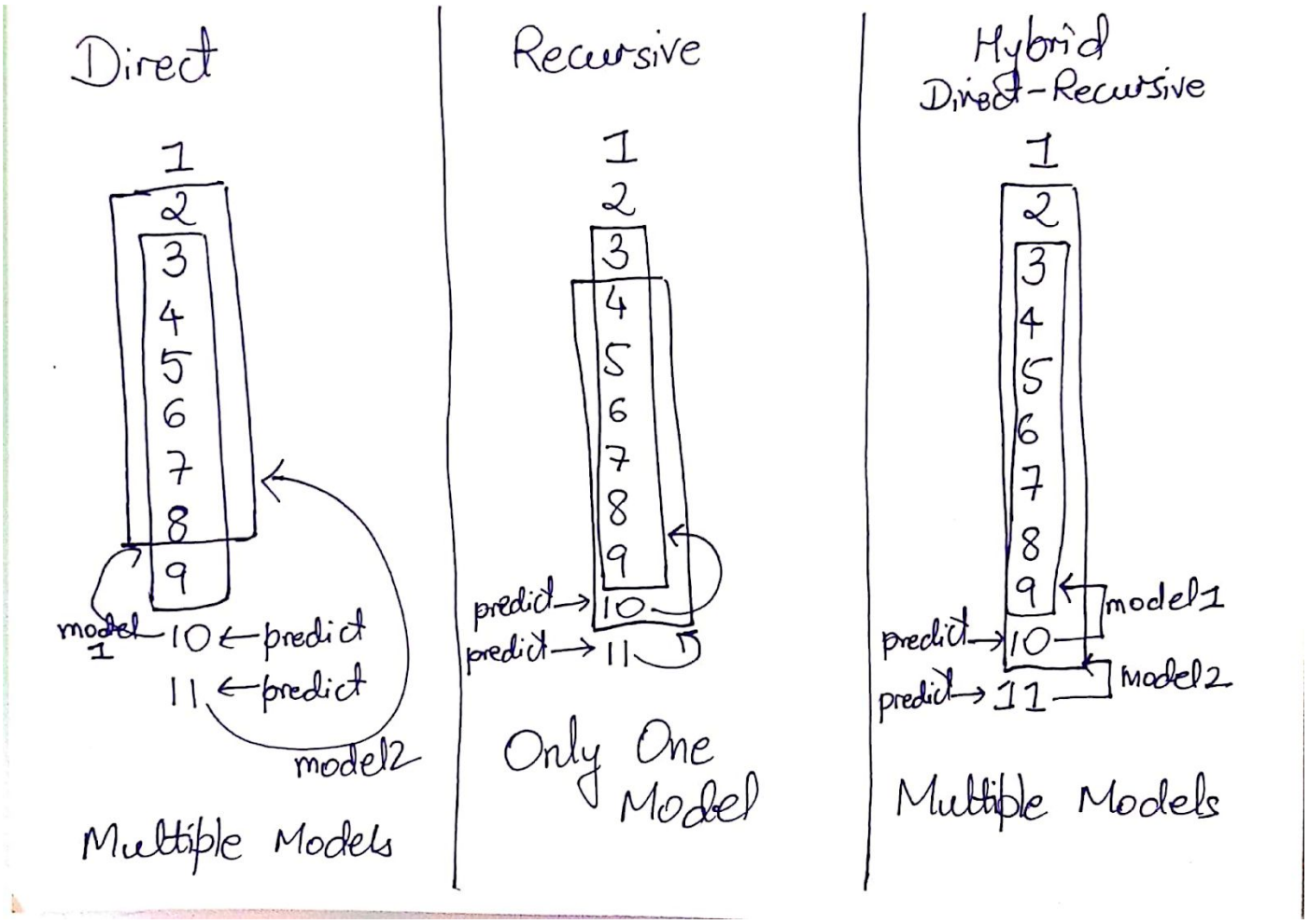
```
prediction(t+1) = model(obs(t-1), obs(t-2), ..., obs(t-n))
prediction(t+2) = model(prediction(t+1), obs(t-1), ..., obs(t-n+1))
```

Direct-Recursive Hybrid Multi-step Forecast: (Separate Model for each time step | in our case 7 models because we want to predict next 7days [22nd to 28th])

```
prediction(t+1) = model1(obs(t-1), obs(t-2), ..., obs(t-n))
prediction(t+2) = model2(prediction(t+1), obs(t-1), ..., obs(t-n))
```

Multiple Output Forecast: (One model to predict all time steps)
[In simple words, by this strategy we build one model on 21days of data and predict next 7days in one shot.]

prediction(t+1), prediction(t+2) = model(obs(t-1), obs(t-2), ..., obs(t-n))



Diagramatic Explanation