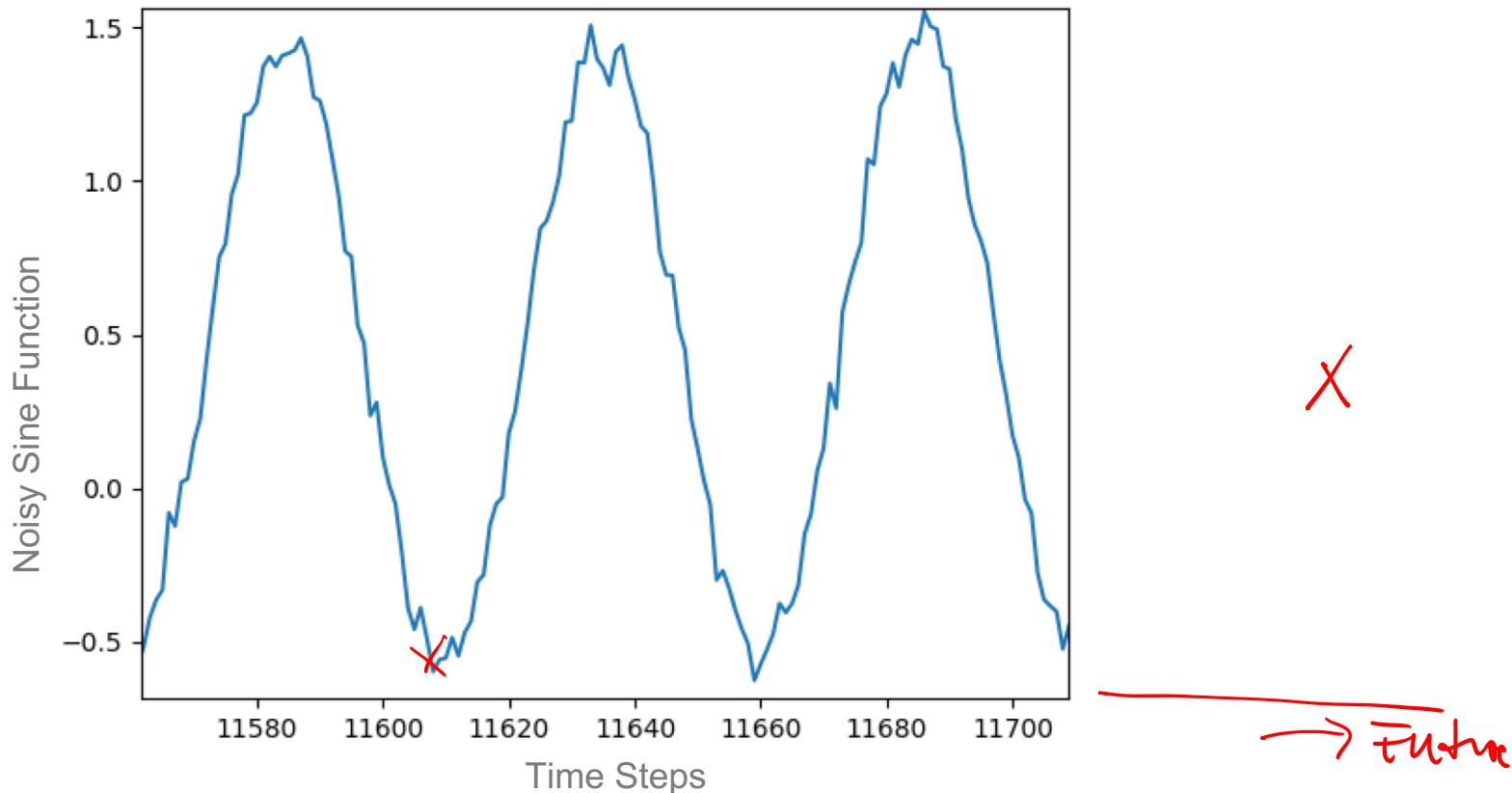

Modeling Sequential Data with an LSTM

Heni Ben Amor, Ph.D.
Assistant Professor
Arizona State University

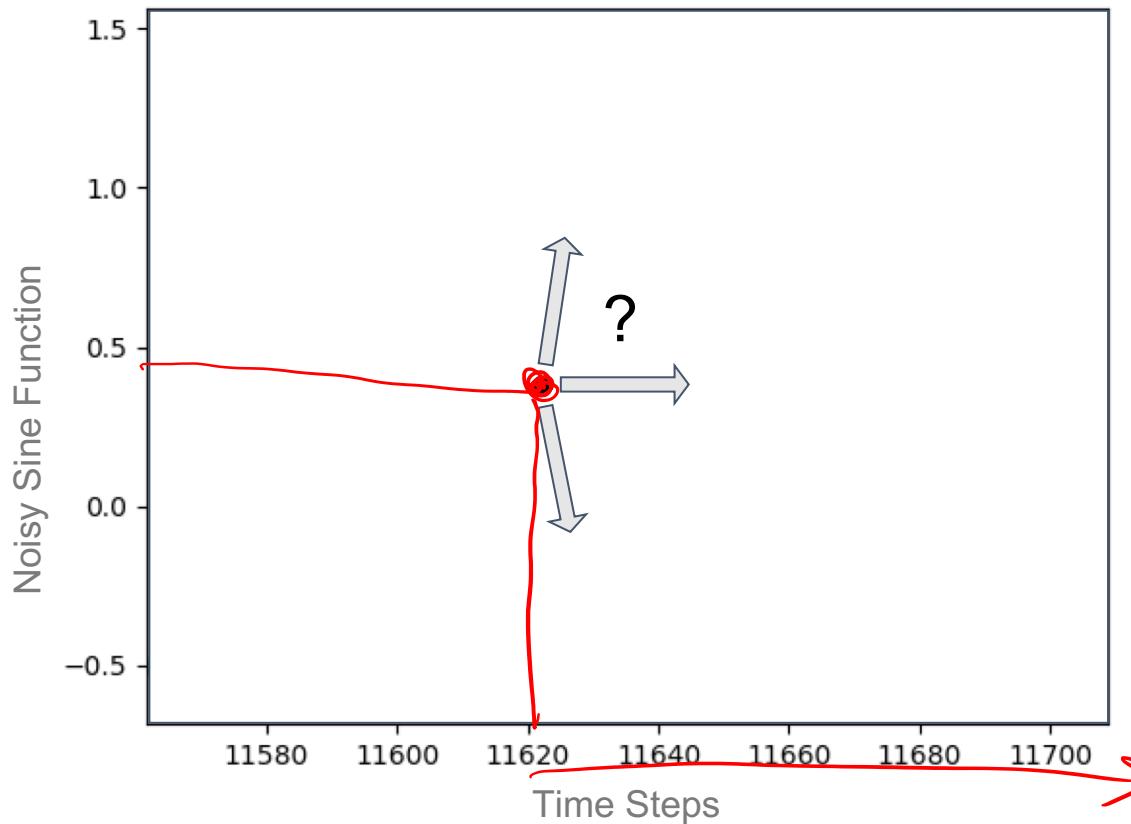
Modeling Sequential Data

| How to model and predict future values of a time series?



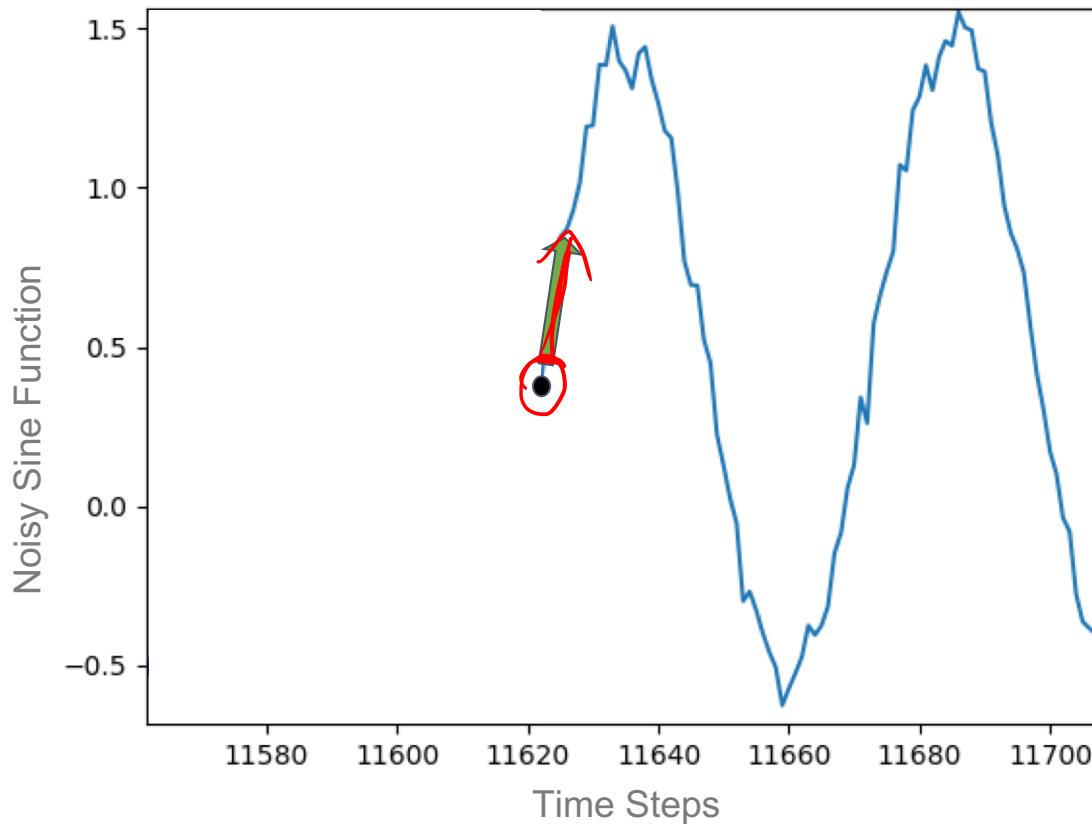
Difficulty with Feedforward Approach

| Given only a point at a time, is the next point increasing or decreasing?



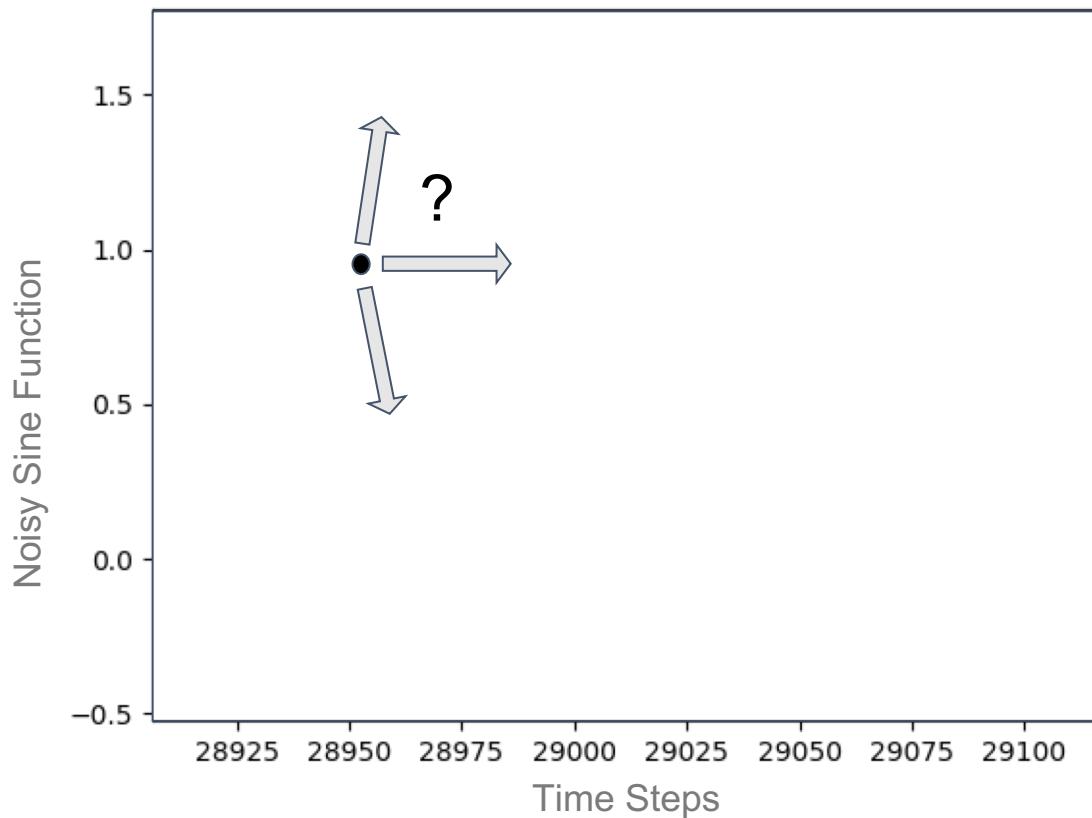
Difficulty with Feedforward Approach

| Given only a point at a time, is the next point increasing or decreasing?



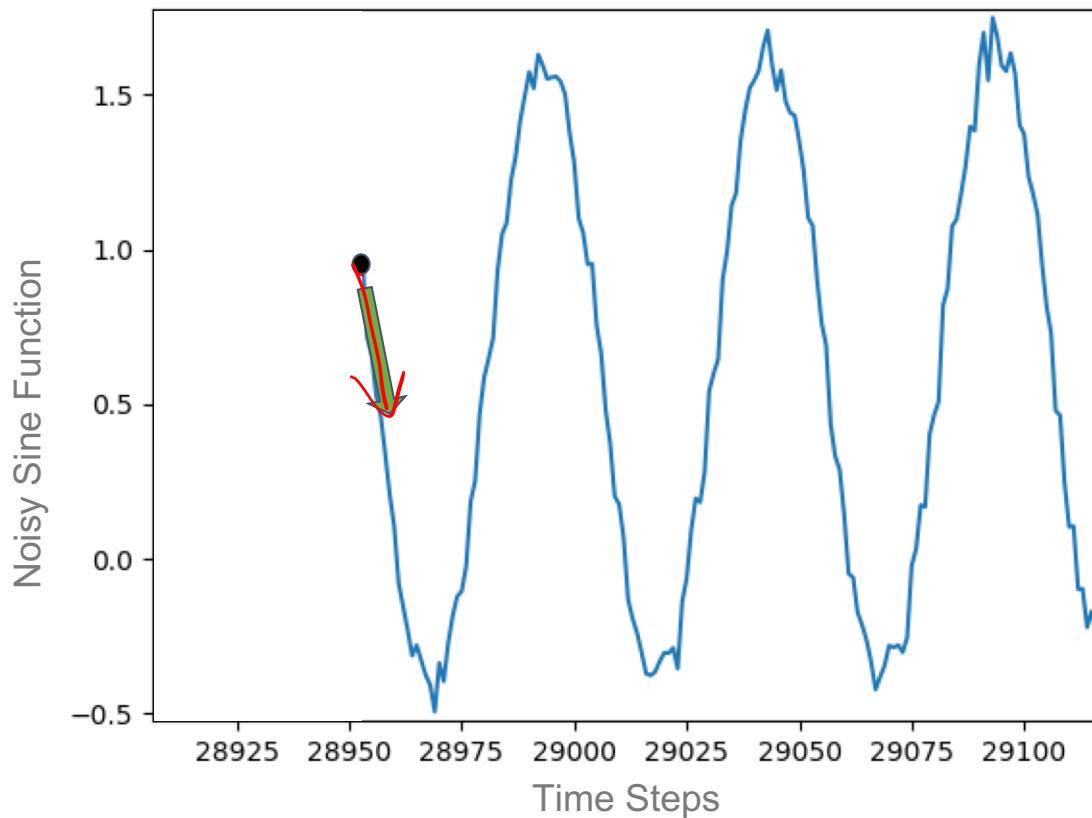
Difficulty with Feedforward Approach

| Given only a point at a time, is the next point increasing or decreasing?



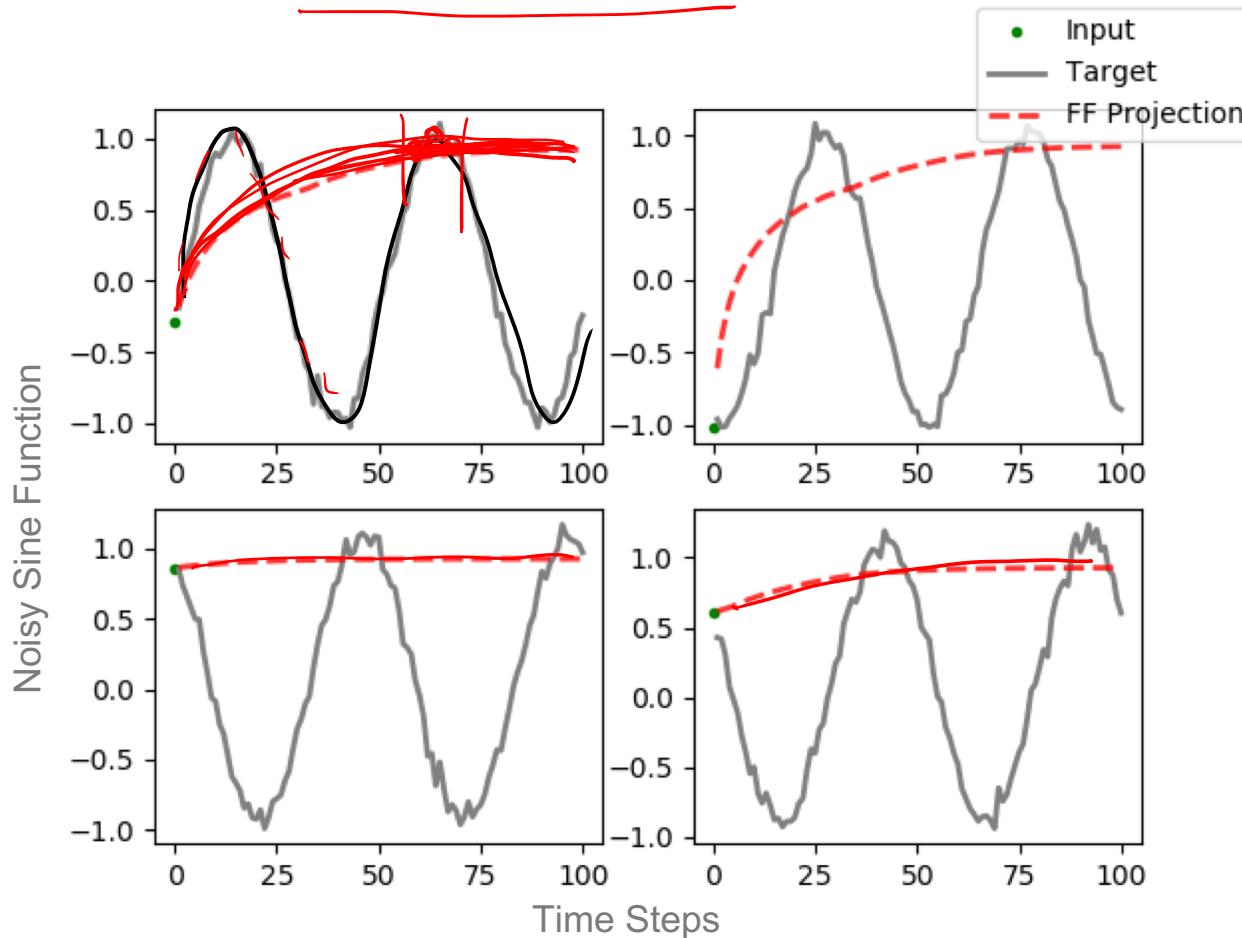
Difficulty with Feedforward Approach

| Given only a point at a time, is the next point increasing or decreasing?



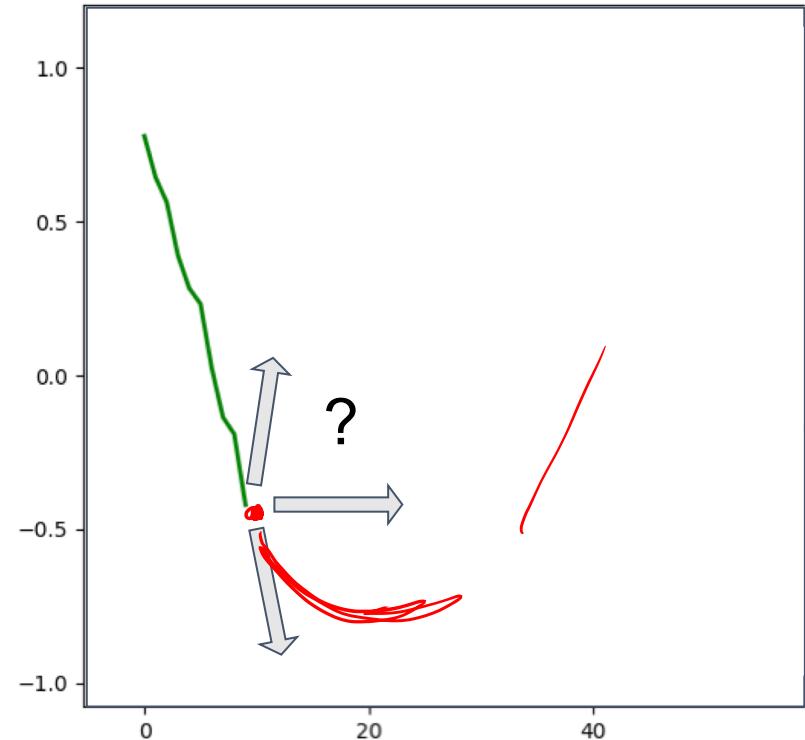
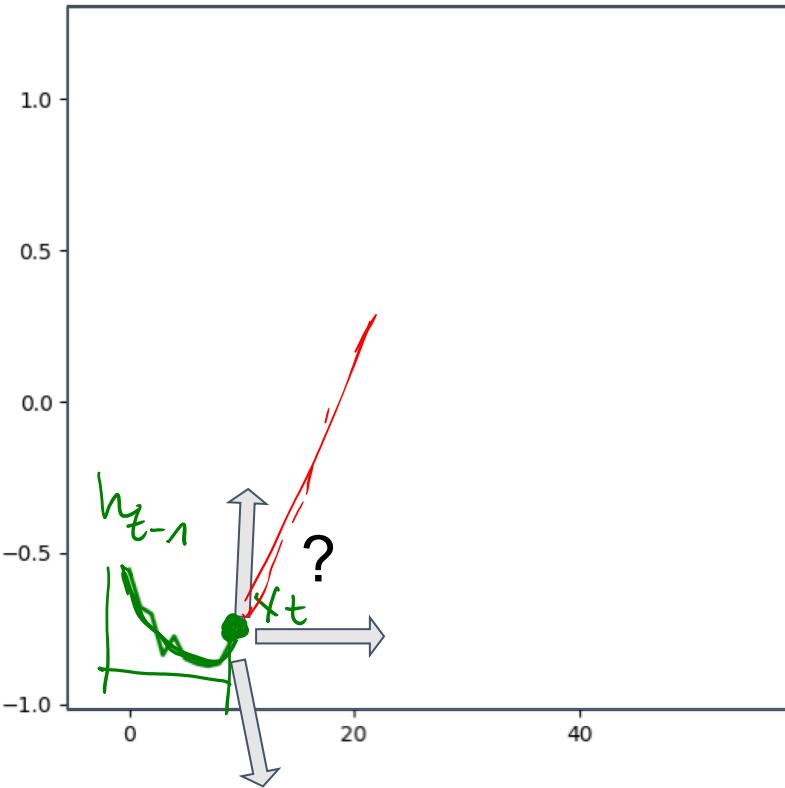
Difficulty with Feedforward Approach

| Our single point feedforward network has no way to know, so it ends up minimizing loss by tending towards some middle ground.



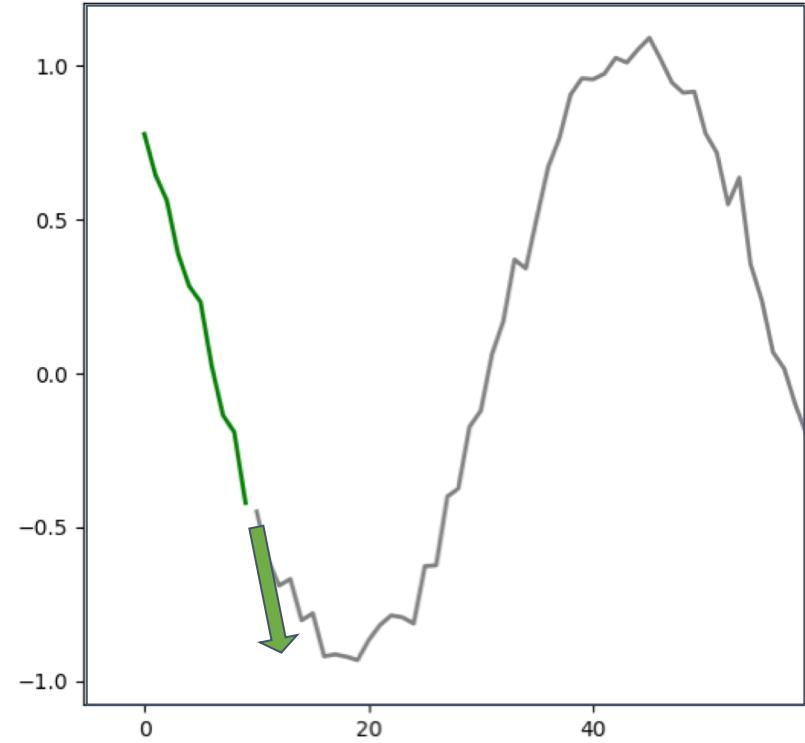
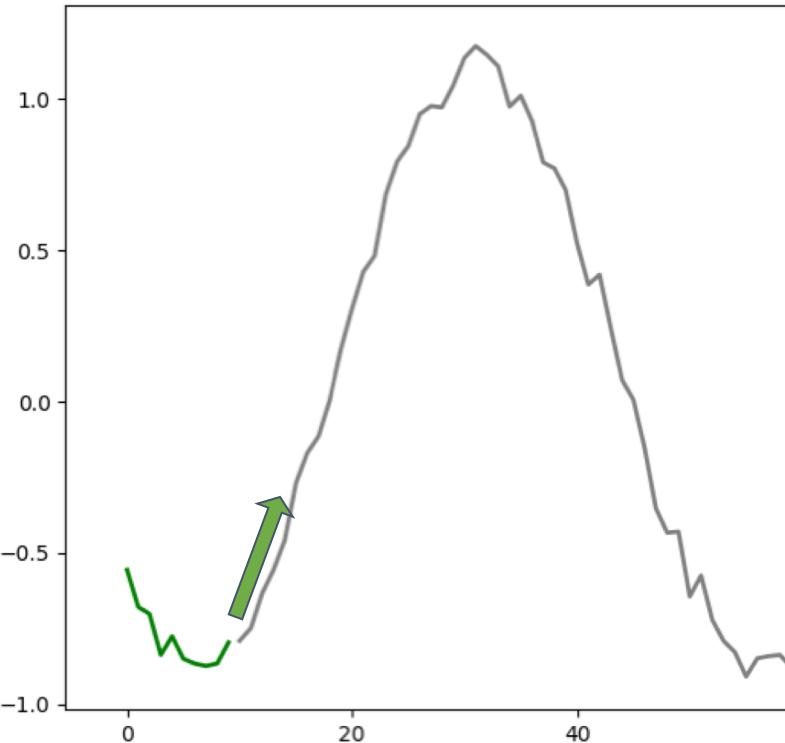
Solution: Recurrent Network

| A recurrent model such as an LSTM allows us to instead make predictions based on a sequence.



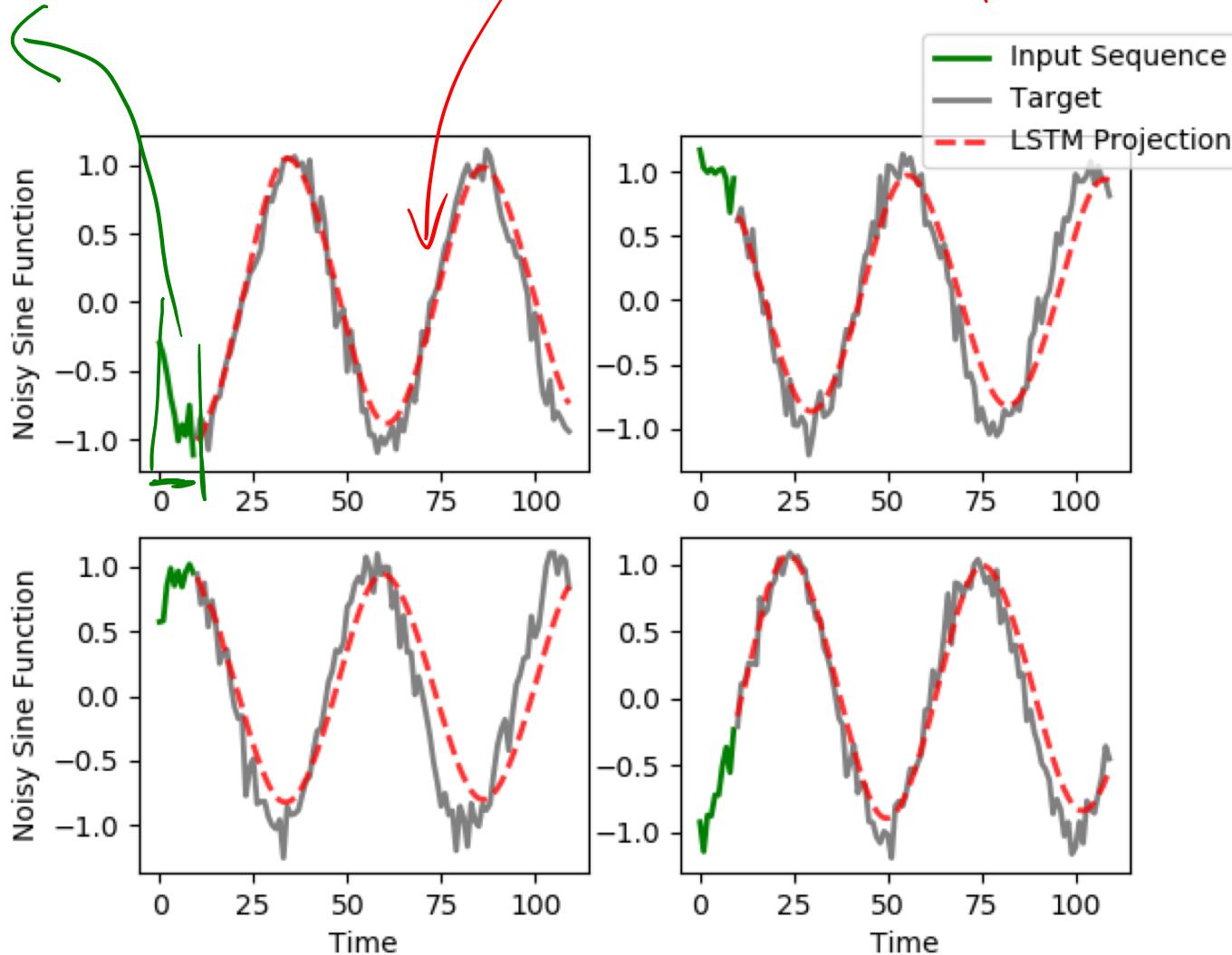
Solution: Recurrent Network

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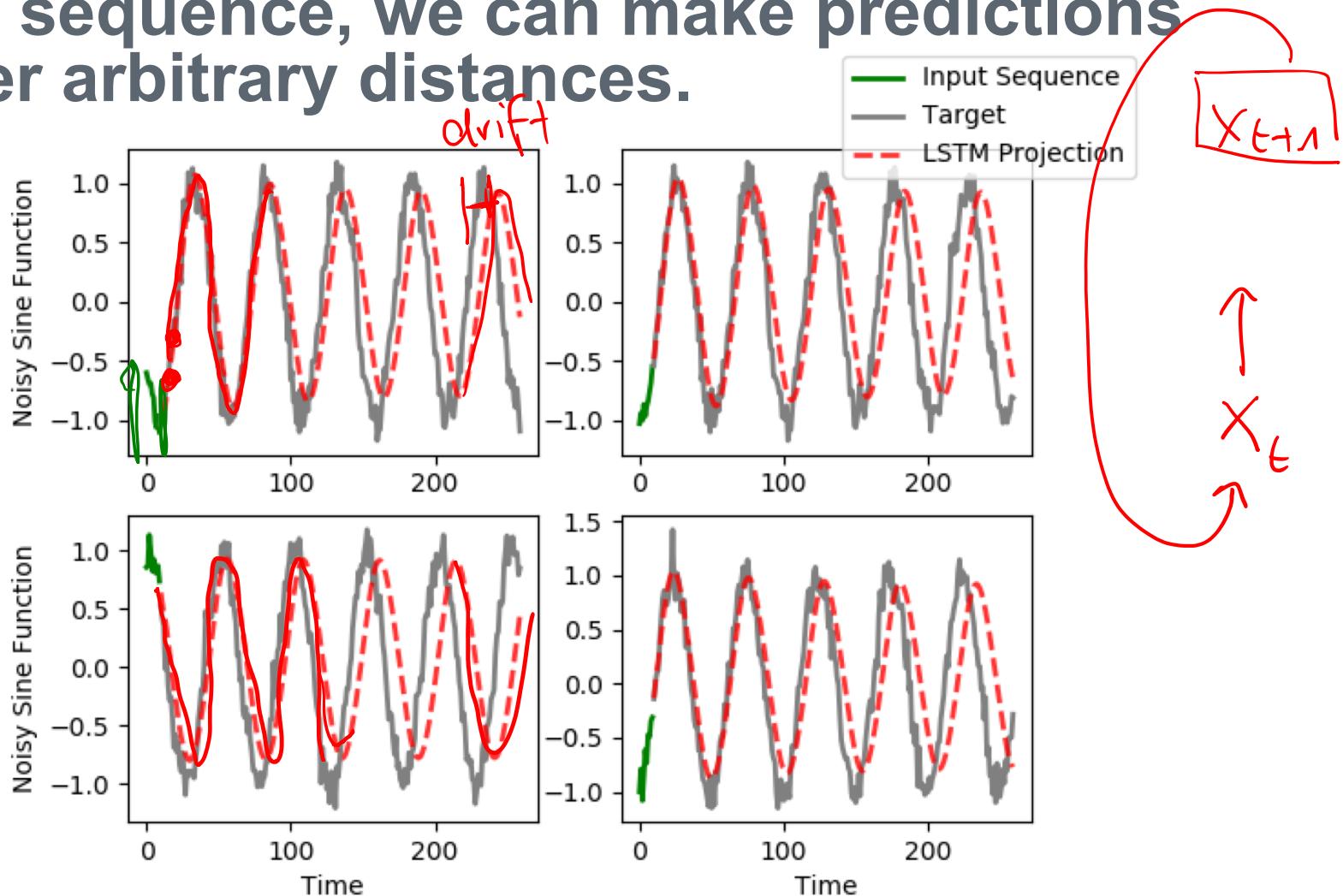
LSTM Projection Using Input Sequence

RNN has seen this ! Prediction of the future time steps

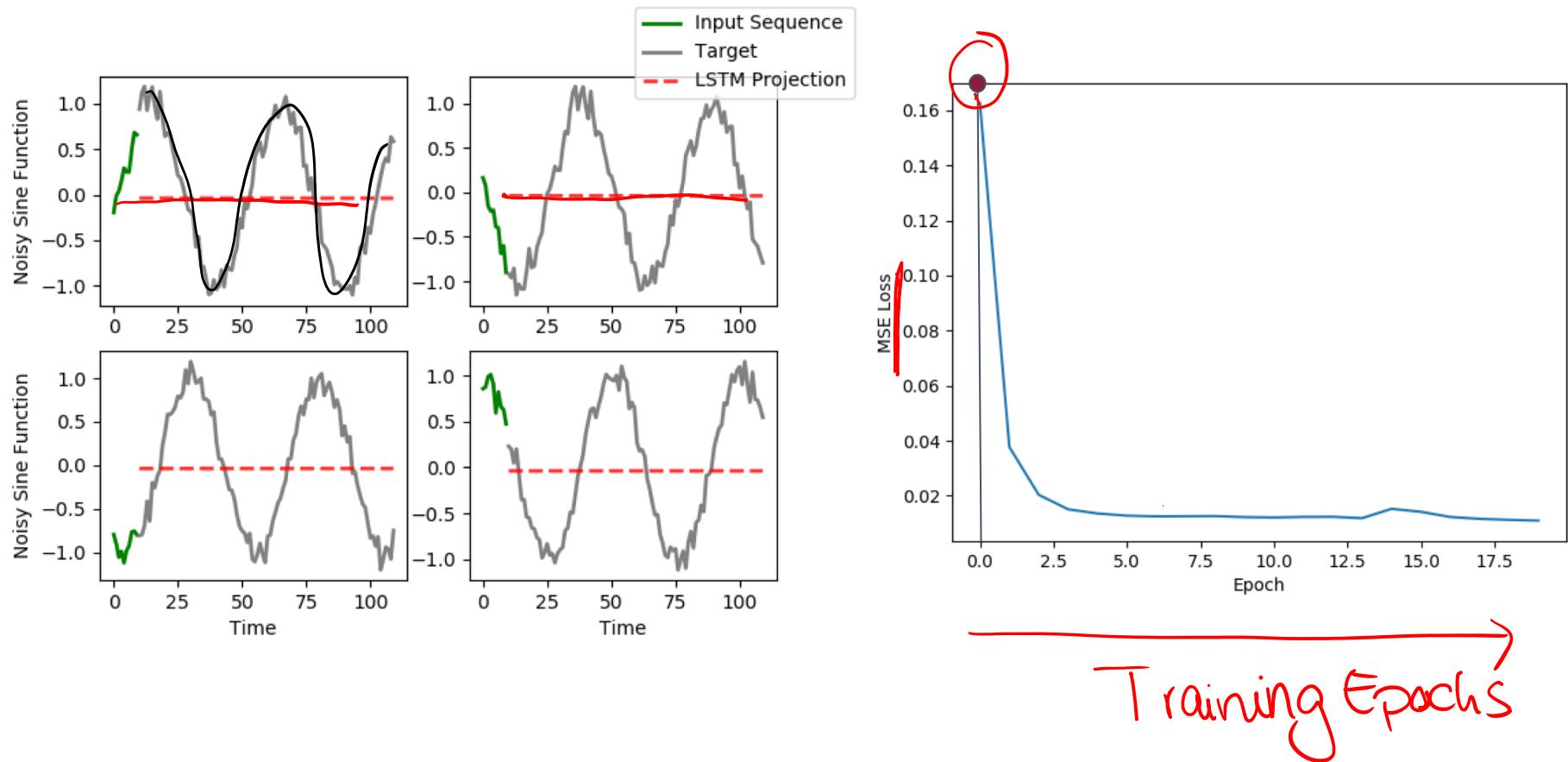


LSTM Projection

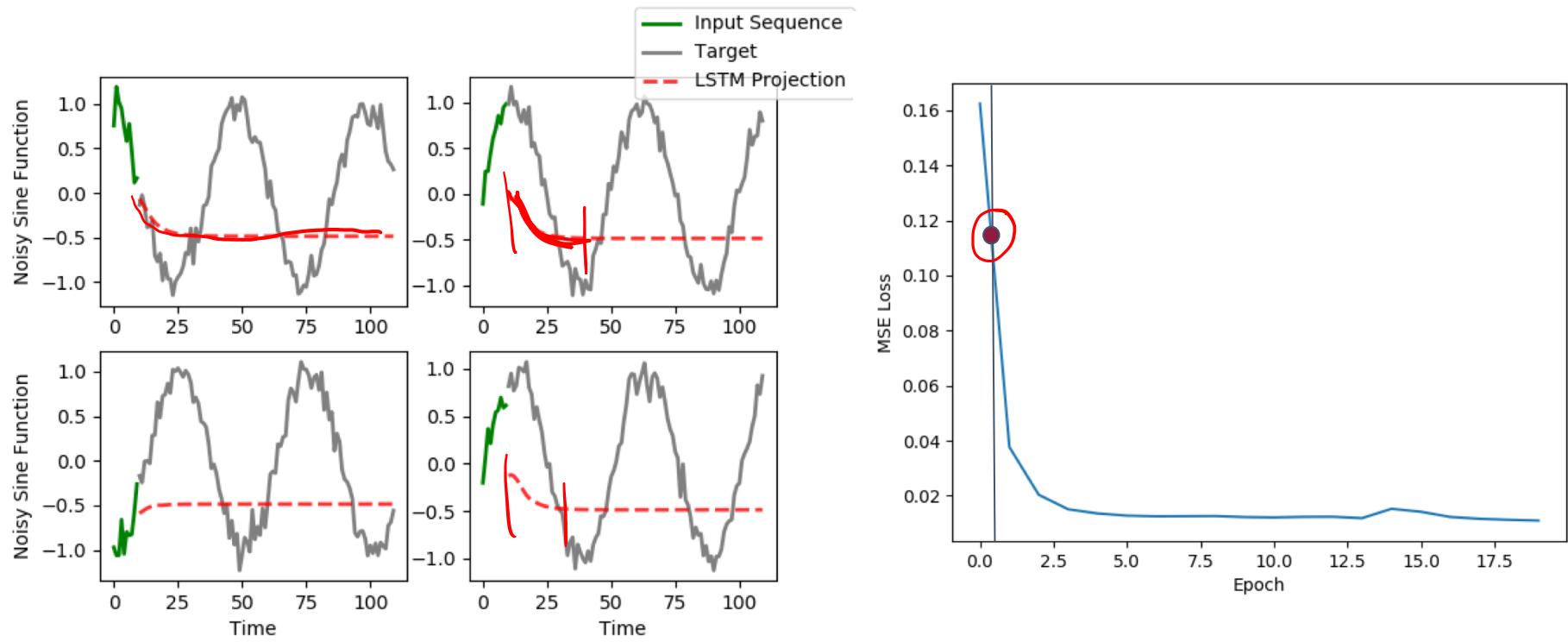
| By using our predictions as new steps in the sequence, we can make predictions over arbitrary distances.



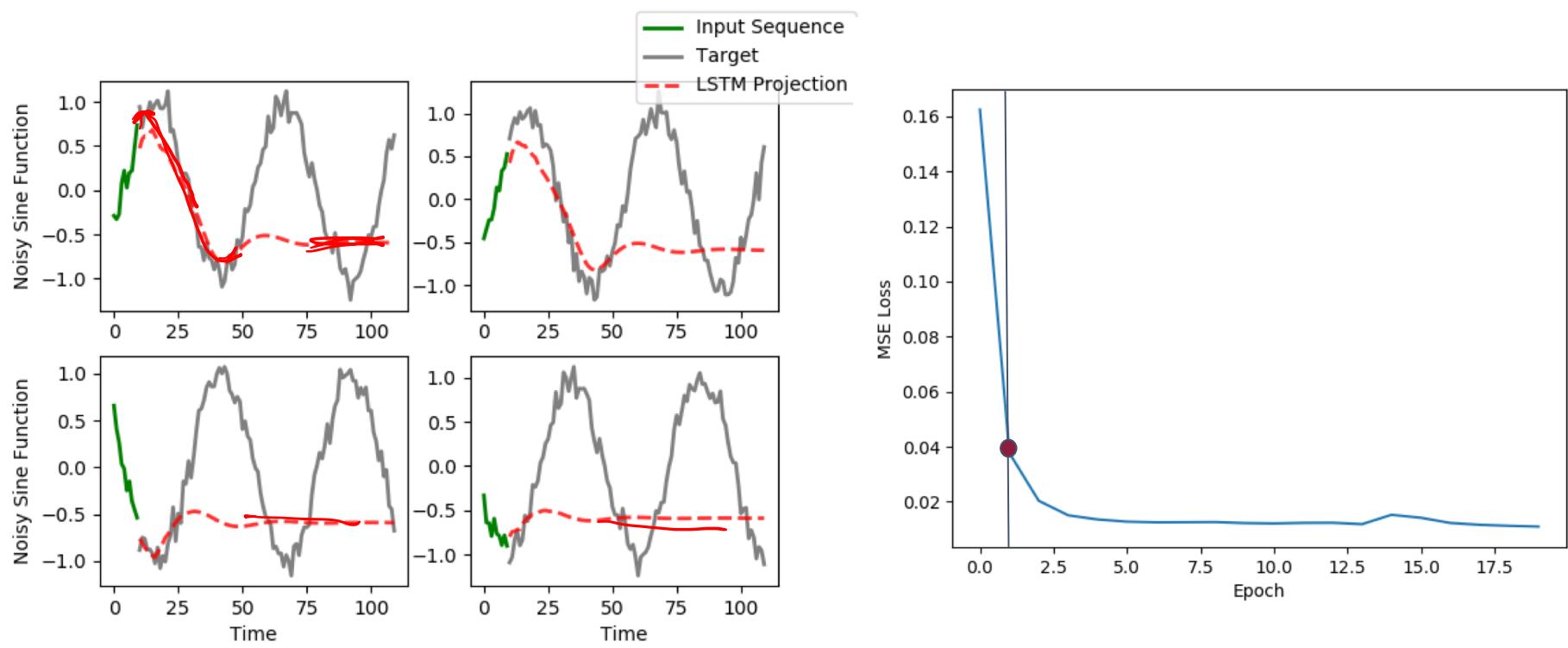
Training the Model



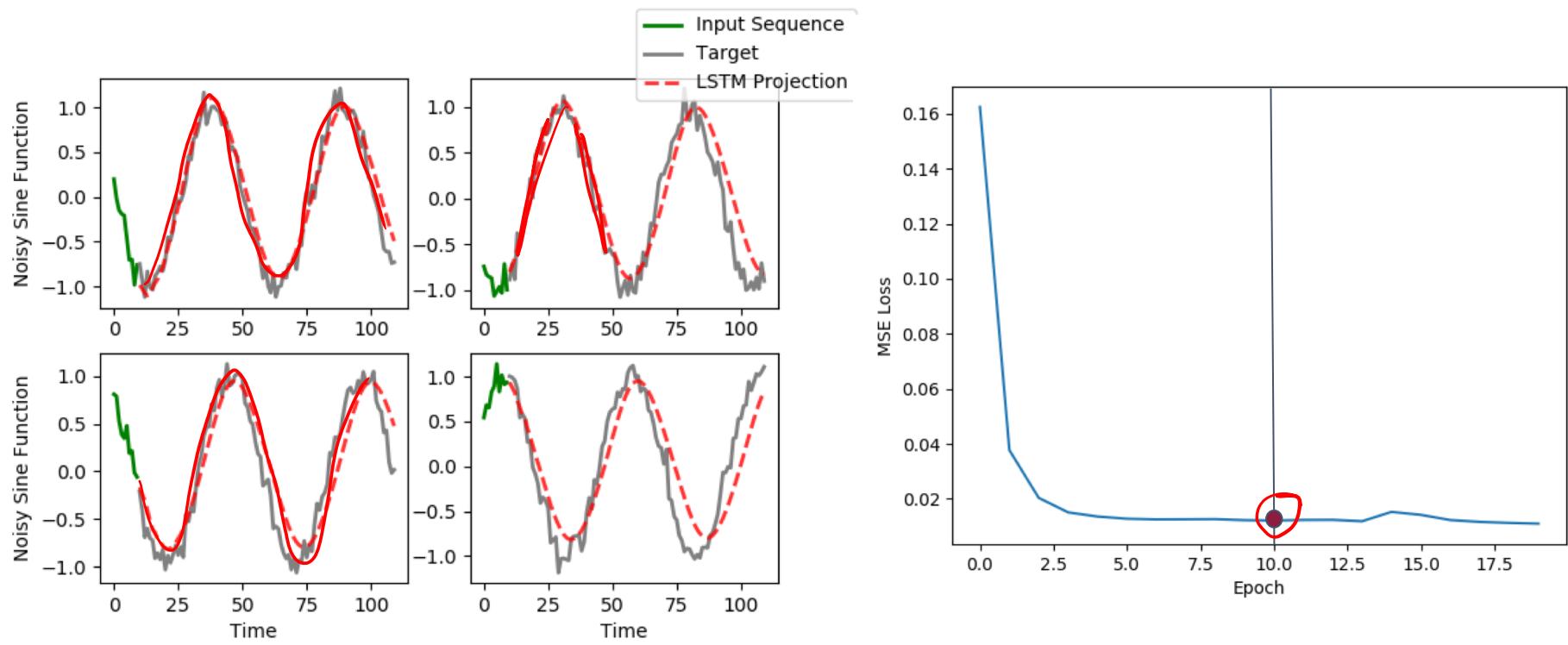
Training the Model



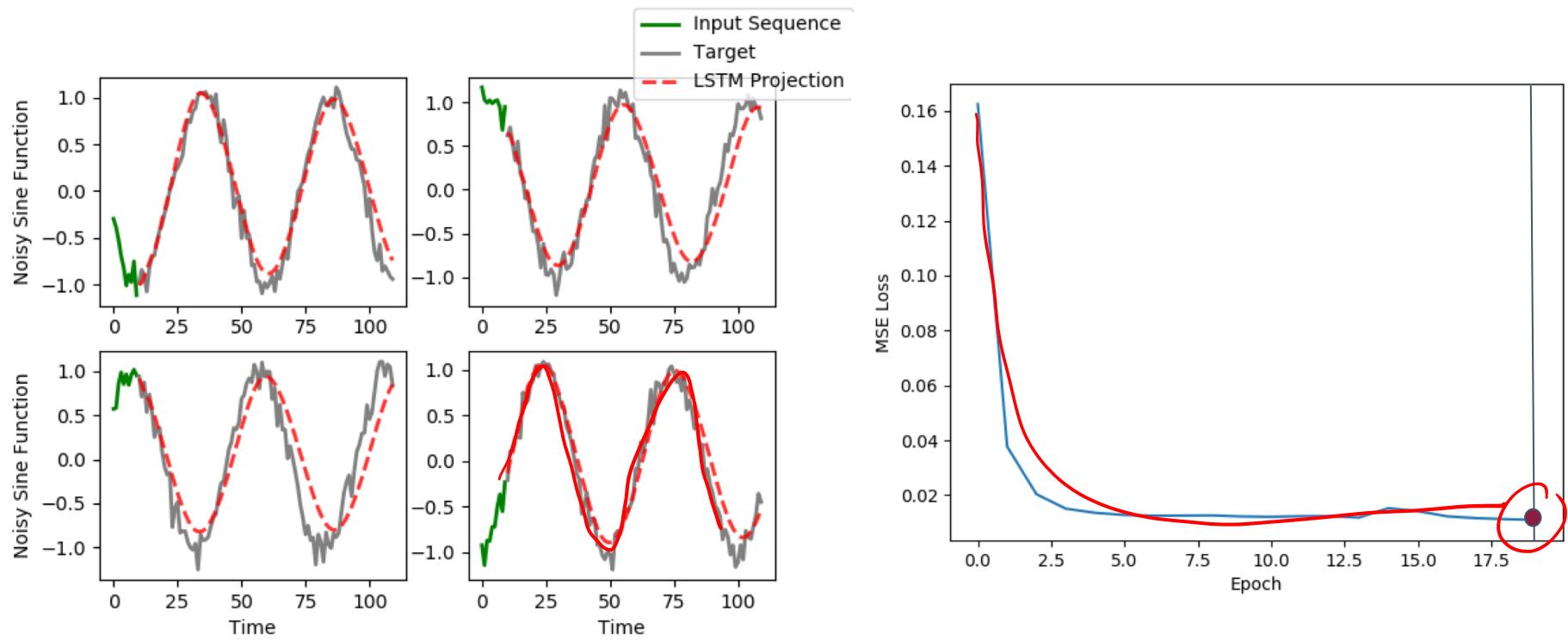
Training the Model



Training the Model



Training the Model



Summary

- | We discussed modeling a time series
- | A simple example using sine curve
- | This needs a RNN for temporal context
- | LSTMs showed excellent performance
- | Visualization of training