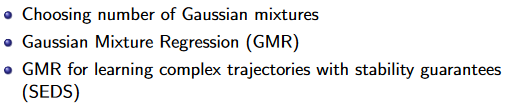
Week 10 Advanced Robotics - Gaussian Mixture Regression  
and Stable Estimator of Dynamical Systems

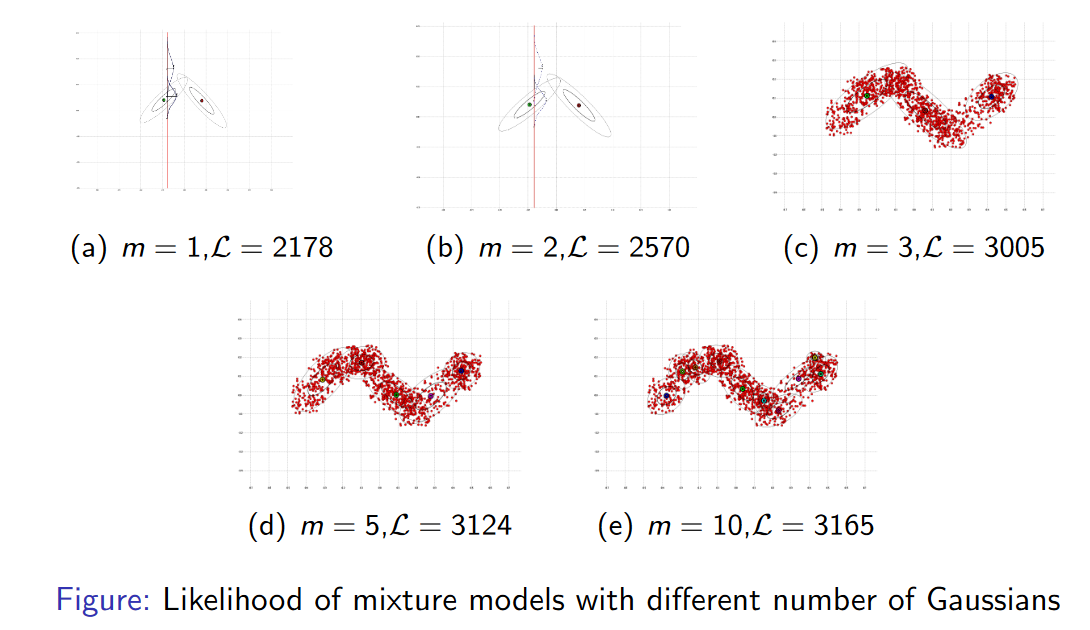
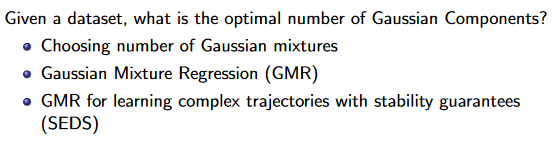
Athanasios Polydoros May 8, 2022

Today’s topics

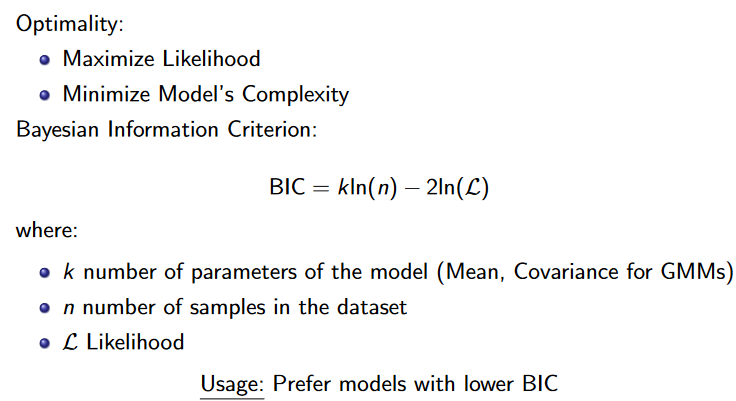


**Optimal number of Gaussian**

We used likelihood function tom measure accuracy of the model



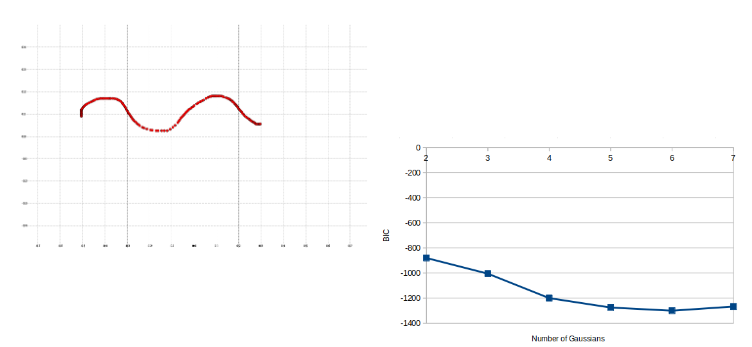
How to choose the optimal number of Gaussians?



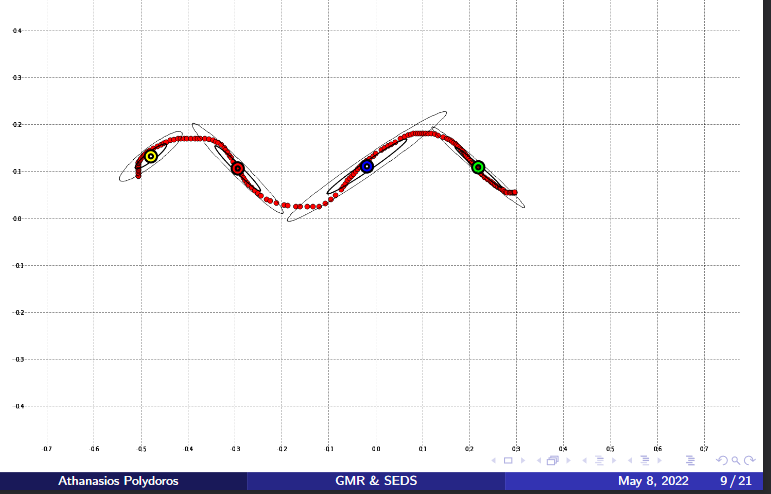
This gives a trade-off between complexity and likelihood, we want a model with very low bayesian criterion. the parameters of Gaussian are mean and covariance

12 parameters if we have 2 Gaussian in a 2 dimensional space.

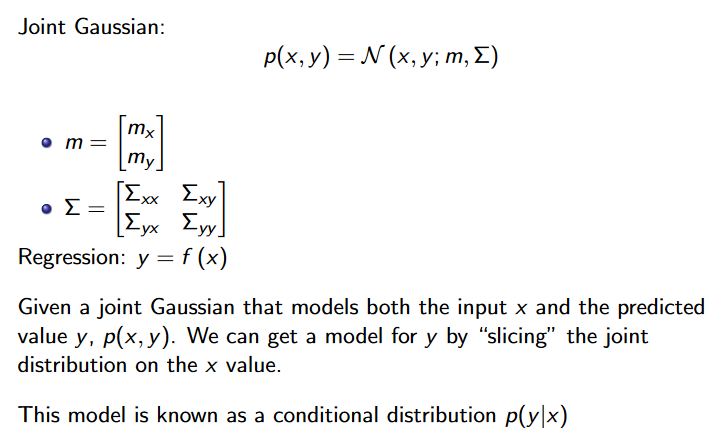
**Using BIC**



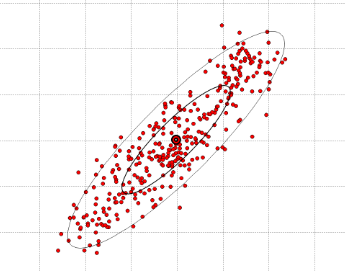
The rate of change of the BIC is minimal at 6 so we can pic either 5 or 6.. We read the graph by taking the clear minimal value but if the minimal is not clear then we pick the closest thing.

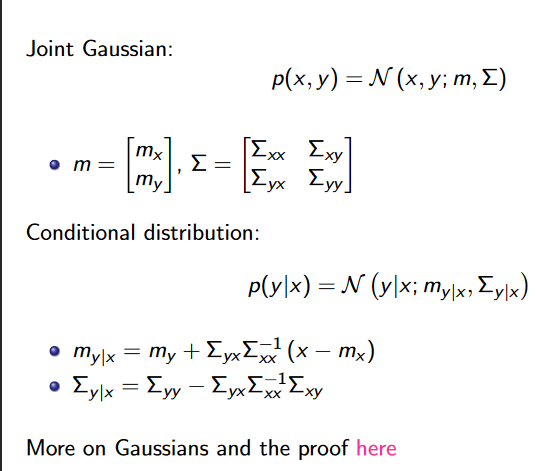
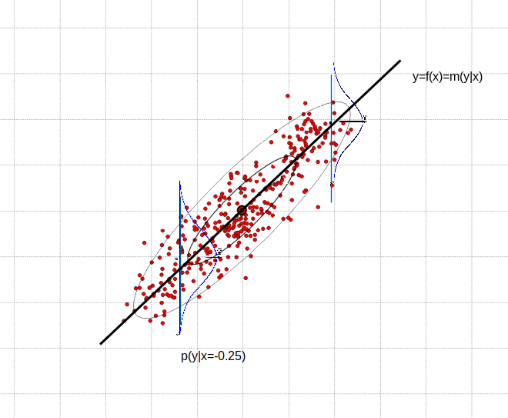
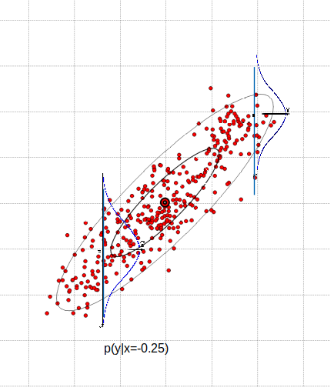
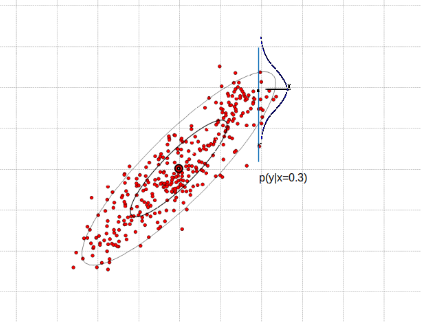
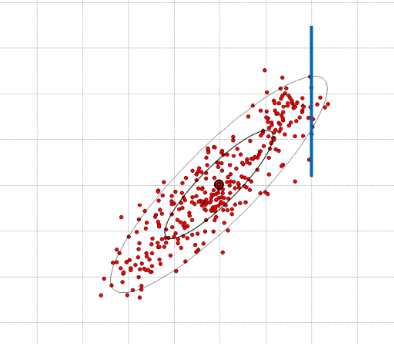


Regression with Gaussian Distributions

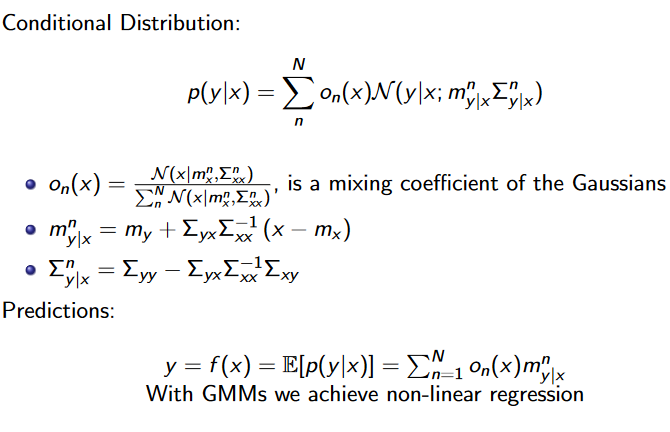
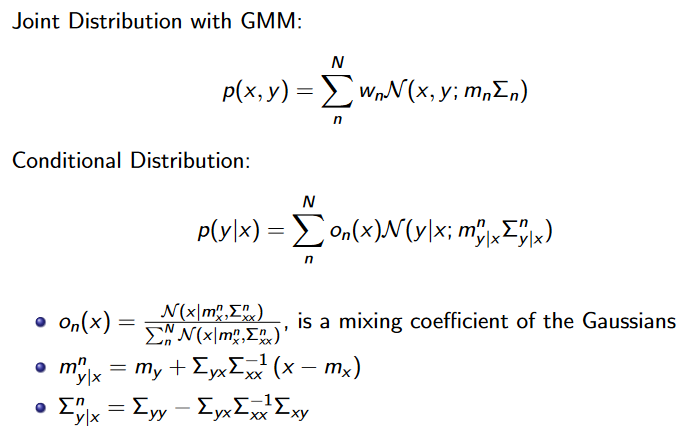
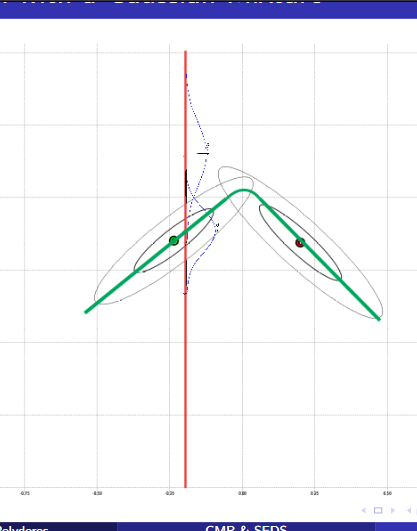
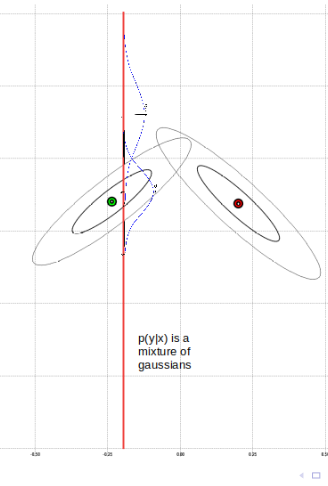
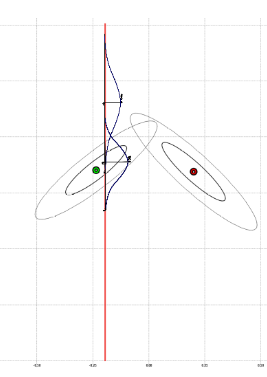
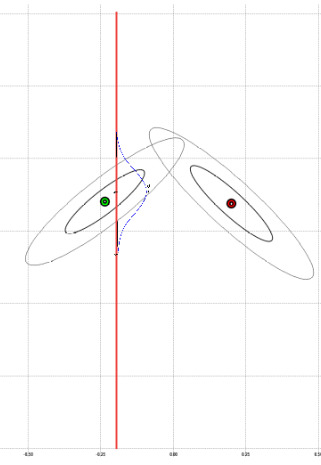
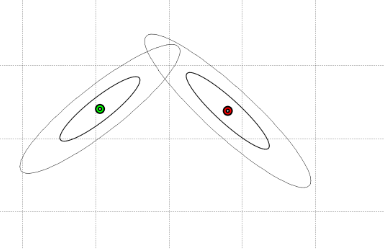
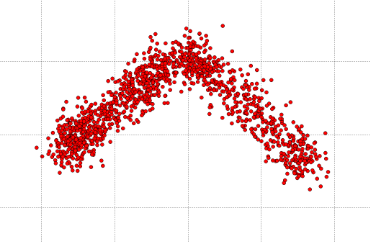
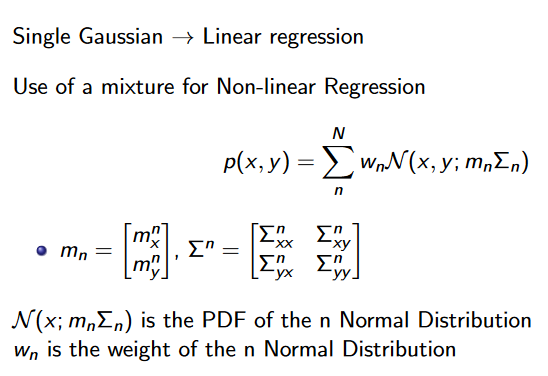


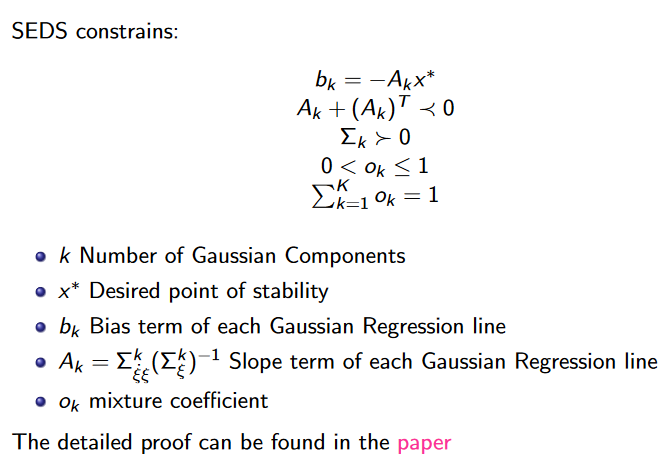
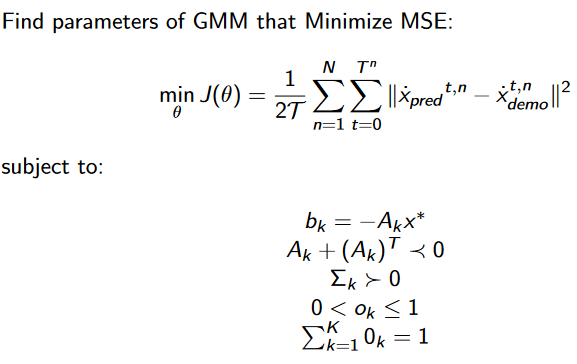
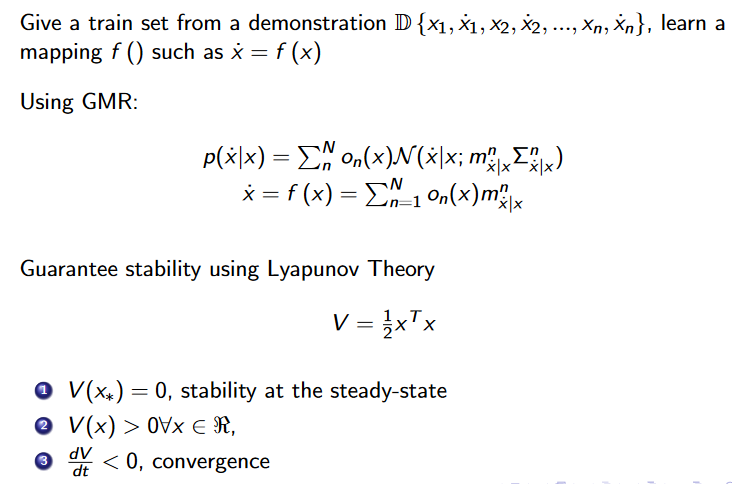
Regression with single Gaussian Distribution

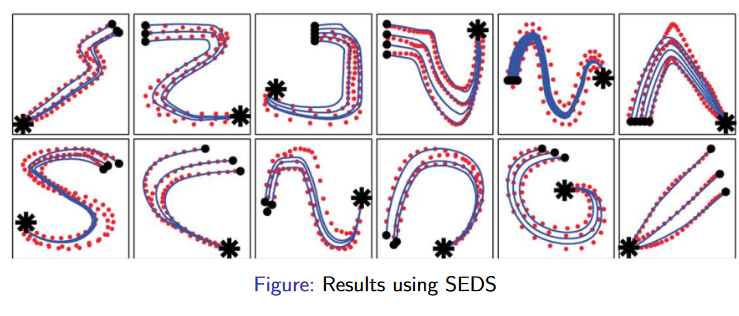




P(y/x) represents the slope, how steep our line is

**Regression with Gaussian Mixtures** **Stable Estimator of Dynamical Systems –SEDS**





WORKSHOP

The demonstrations are not optimally modelled because it would be impossible to model all of them accurately with the same number of Gaussians for all of them due to the complexities and differences in each shape.

The C shape is not largely affected by a change in different numbers of Gaussian components however the angle is, 10 seems to be the optimal value for the Angle while any value works for the C shape.

Increasing the number of Gaussian models too greatly will cause the code to exit before it reaches convergence as the max number of iterations will be exceeded.

For the Line and C-Shape demonstrations I would use a linear model for the Line and SEDS for the C-Shape because the line is simple enough to work efficiently with 1 gaussian whereas the C-Shape models are more complex and therefore SEDS more accurately illustrates the shapes.