Report for exercise 2 from group H

Tasks addressed:	5
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Last compiled:	2019–11–25
Source code:	https://gitlab.lrz.de/ga53rog/praktikum-ml-crowd

The work on tasks was divided in the following way:

Ahmad Bin Qasim (03693345)	Task 1	33%
	Task 2	33%
	Task 3	33%
	Task 4	33%
	Task 5	33%
Kaan Atukalp (03709123)	Task 1	33%
	Task 2	33%
	Task 3	33%
	Task 4	33%
	Task 5	33%
Martin Meinel (03710370)	Task 1	33%
	Task 2	33%
	Task 3	33%
	Task 4	33%
	Task 5	33%

Report on task 1, Vector fields, orbits, and visualization

Report on task 2, Common bifurcations in nonlinear systems

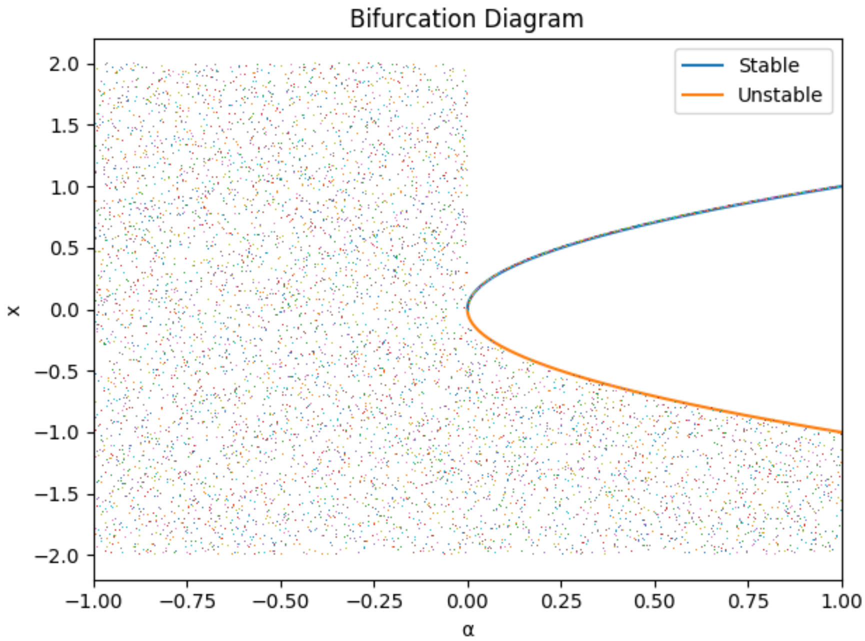

Figure 1: The bifurcation diagram for equation 6 with α in (-1,1)

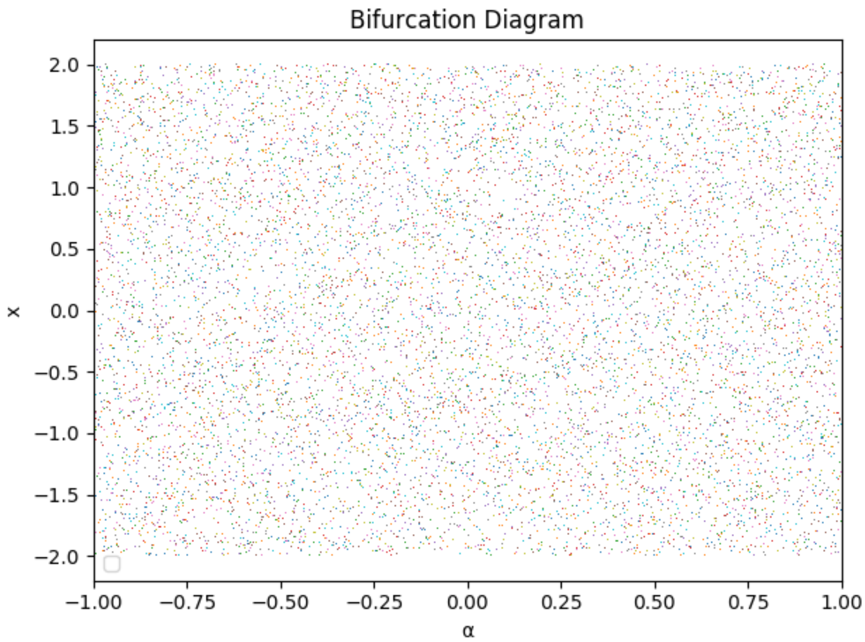

Figure 2: The bifurcation diagram for equation 7 with α in (-1,1)

We know that, for two dynamical systems to be topologically equivalent, there should exist homeomorphism of the parameter space and a parameter-dependent homeomorphism of the phase space.

1. The bifurcation that occurs at $\alpha = 0$ is, saddle node bifurcation.
2. The dynamical systems explained by equation 6 and 7 are not topologically equivalent for $\alpha = 1$ because, although they have the same normal form. The dynamical system explained by equation 7 has no steady state for $\alpha = 1$, instead the steady state of the dynamical system in question exists at $x0 = \pm\sqrt{\frac{\alpha-2}{2}}$ only for $\alpha > 2$ as shown by figure 3. According to the definition of topological equivalence mentioned before, for $\alpha = 1$ the parameter-dependent homeomorphism of the phase space does not exist.
3. The dynamical systems explained by equation 6 and 7 are not topologically equivalent for $\alpha = -1$ as well, because at $\alpha = -1$ neither of the dynamical systems have any steady states.

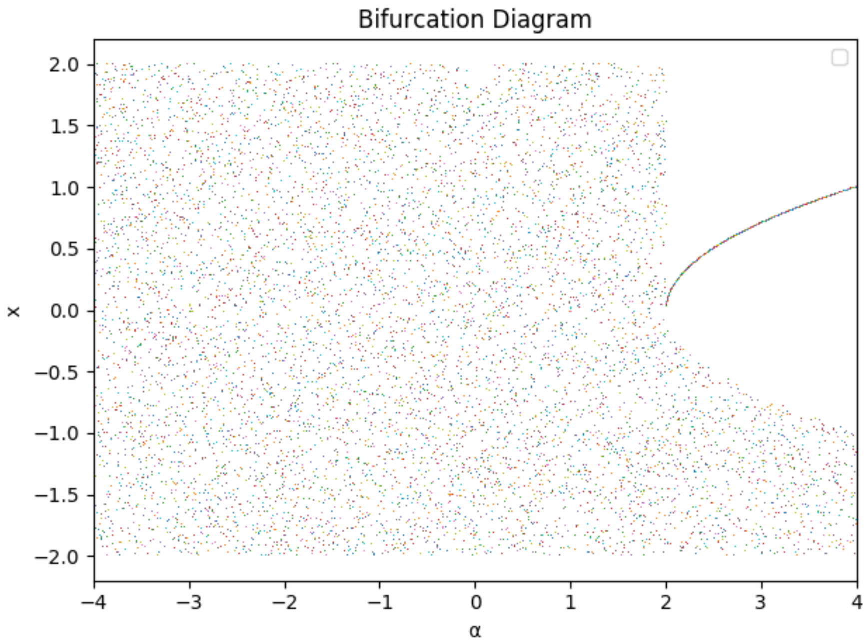

Figure 3: The bifurcation diagram for equation 7 with α in (-4,4)

Report on task 3, Bifurcations in higher dimensions

Report on task 4, Chaotic dynamics

Report on task 5, Bifurcations in crowd dynamics