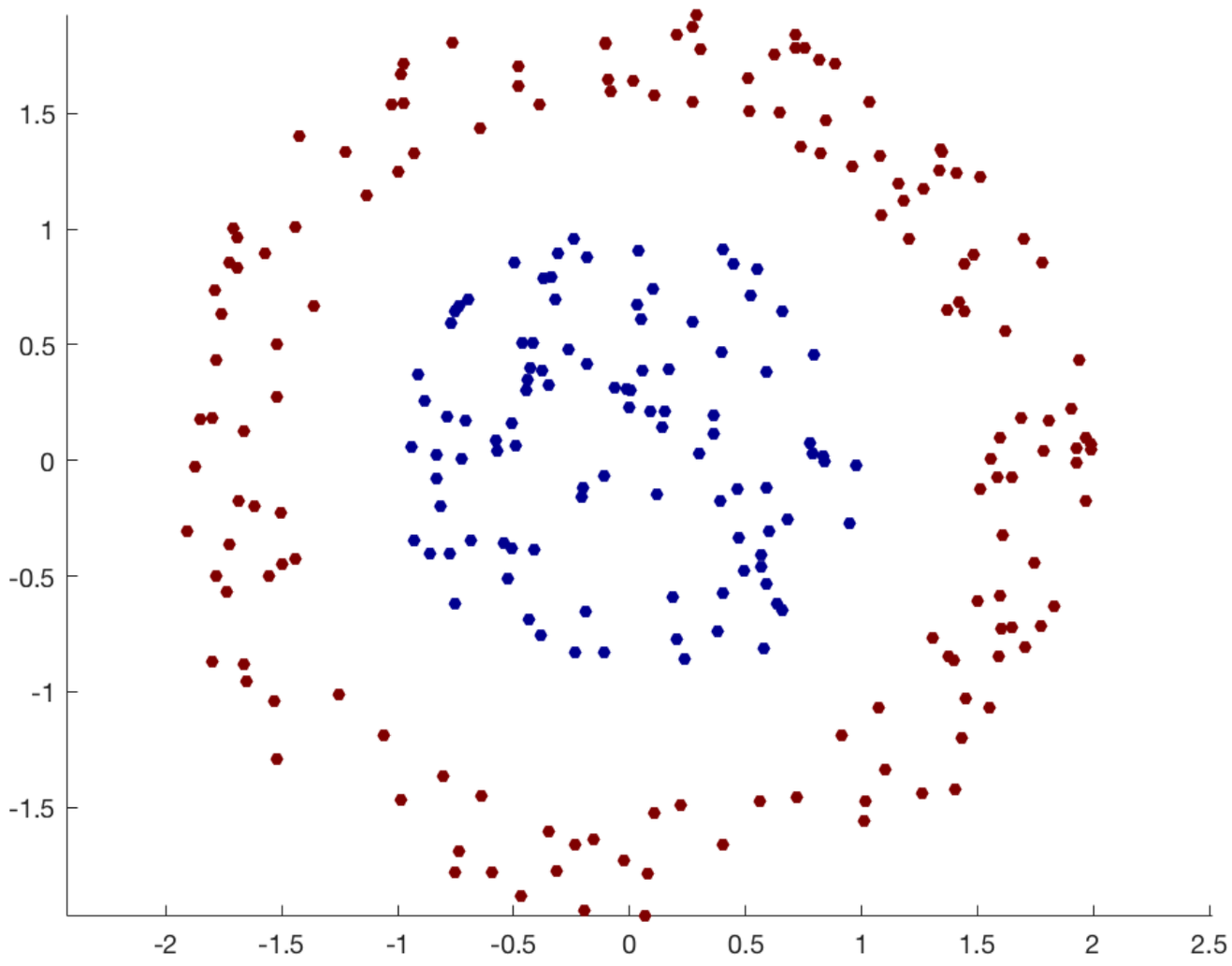
CMSE 820: Mathematical Foundations of Data Science

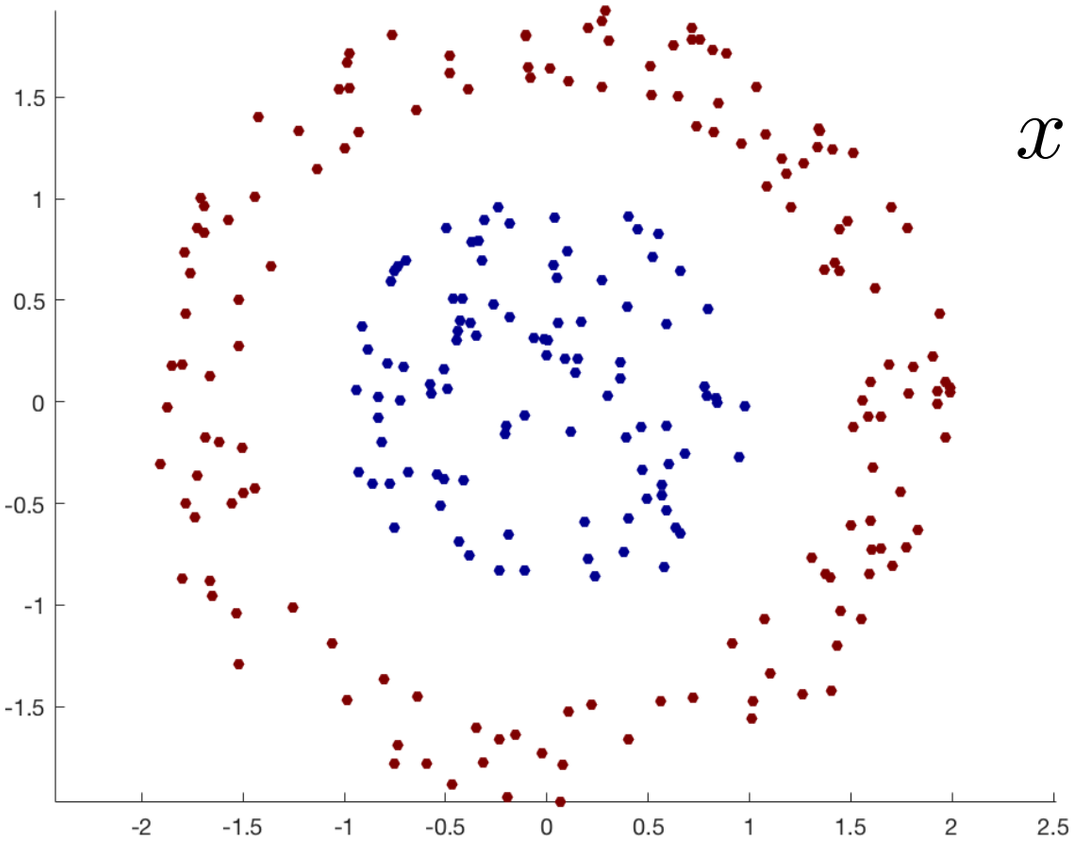
Lecture 06

Nonlinear decision boundaries

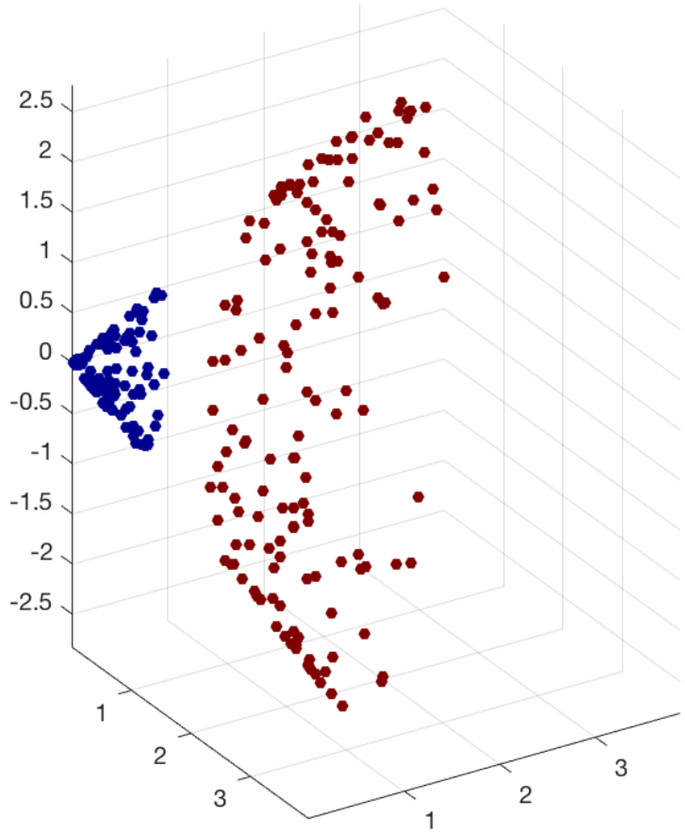


Two class data with circular decision boundary

Nonlinear decision boundaries

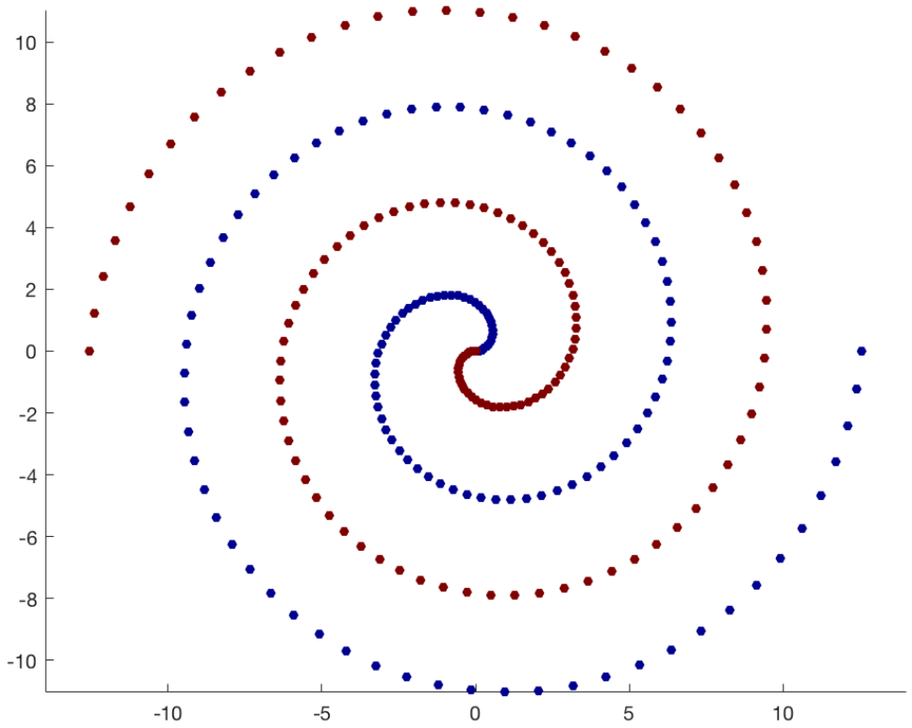


$$x \mapsto \Phi(x)$$

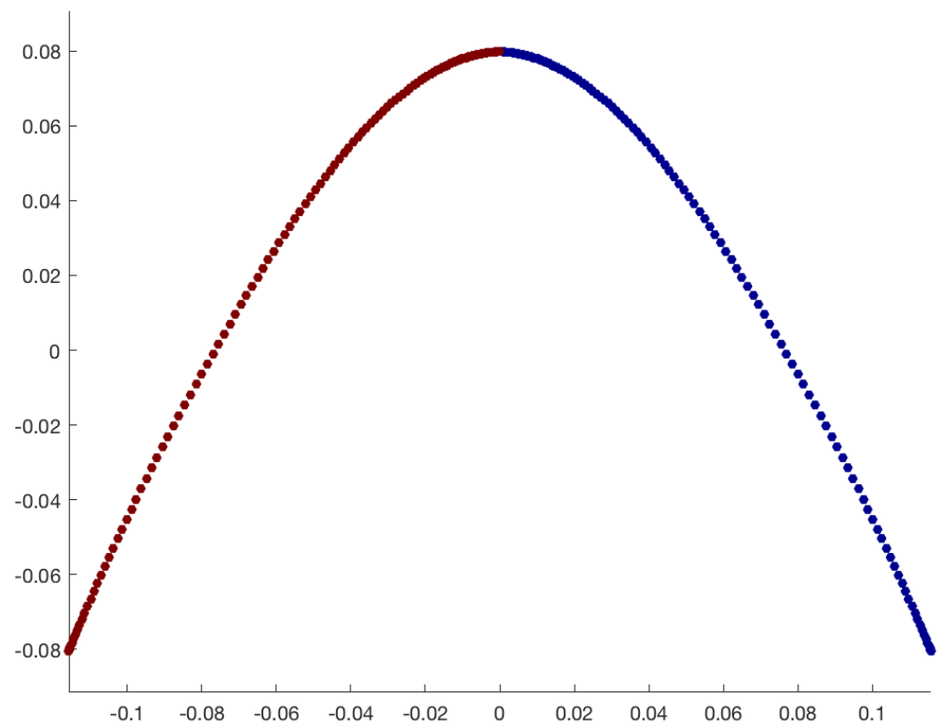


The kernel $k(x, x') = \langle x, x' \rangle^2$ induces a nonlinear map $\Phi(x) = (x[1]^2, x[2]^2, \sqrt{2}x[1]x[2])$, which makes the data *linearly separable*.

Nonlinear decision boundaries



$$x \mapsto \Phi(x)$$



The kernel $k(x, x') = \exp(-\|x - x'\|^2/2\sigma^2)$ induces a nonlinear map $\Phi(x)$, which unwinds the data and makes it *linearly separable*.