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# LOCAL REGRESSION

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**Introduction**

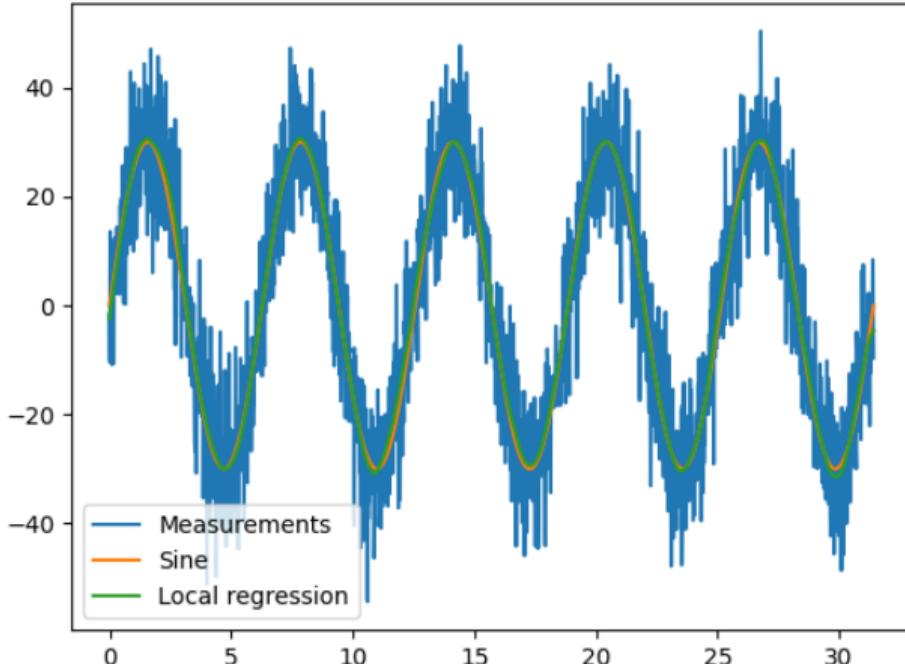
**On local regression**

**Local PCR and PLSR**

**Sources**

# Reasons for local regression

- ▶ Life is not linear
- ▶ But it could be
- ▶ Lets pretend it is piece-wise linear



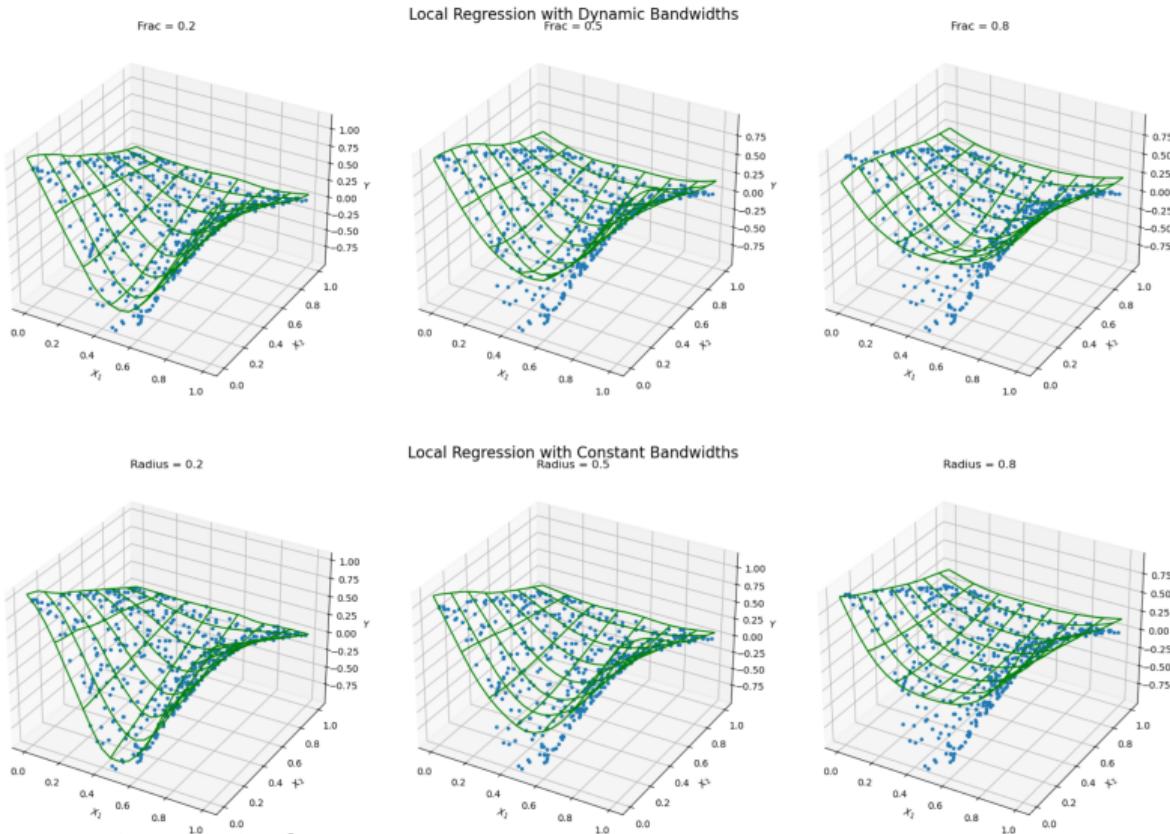
# Bandwidth

- ▶ Window function
  - ▶ Which neighbouring samples with what weight?
- ▶ Bias - variance trade-off
- ▶ Constant bandwidth
- ▶ Nearest neighbour bandwidth

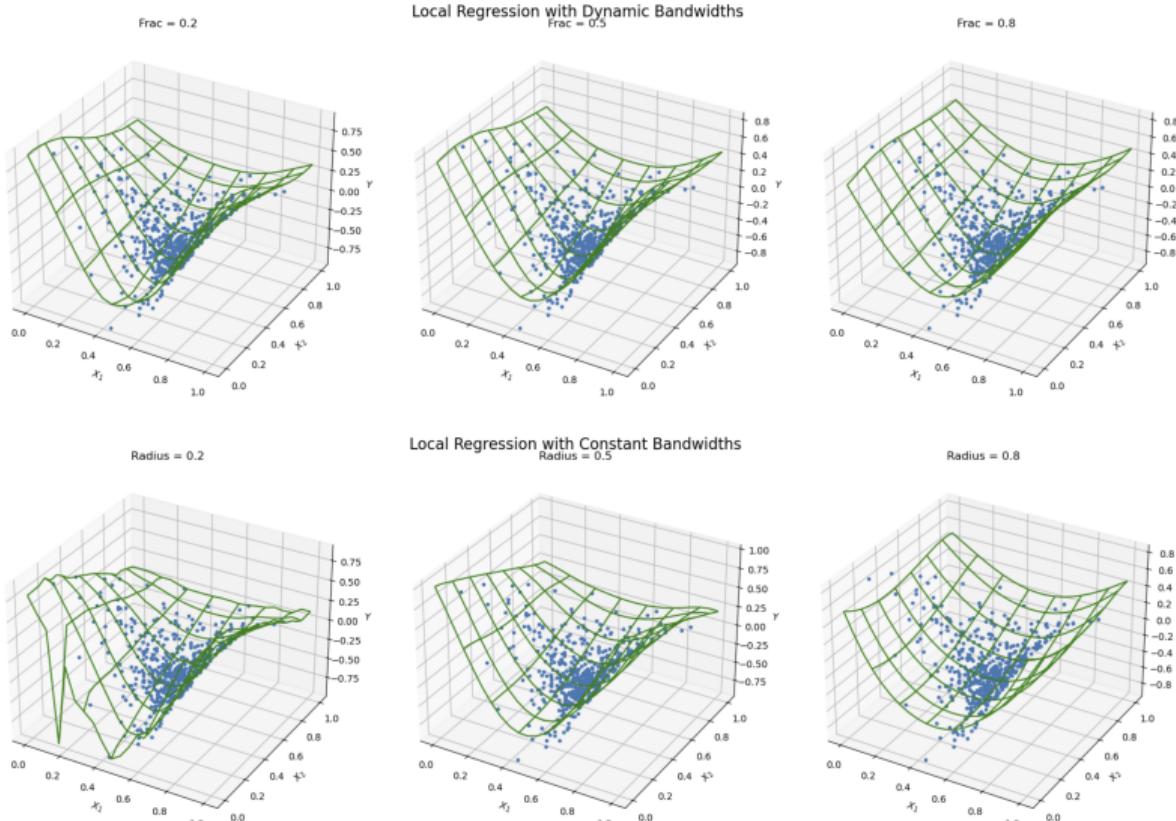
# Overfitting and Underfitting

- ▶ Local polynomial degree
- ▶ Choose low polynomial degree
  - ▶ Concentrate on finding satisfactory bandwidth
  - ▶ Local linear or local quadratic fit

# Code examples and Results - Uniform distributed dataset

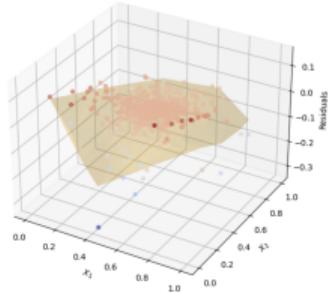


# Code examples and Results - Nonuniform distributed dataset

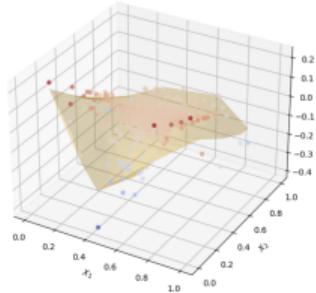


# Diagnostic tool

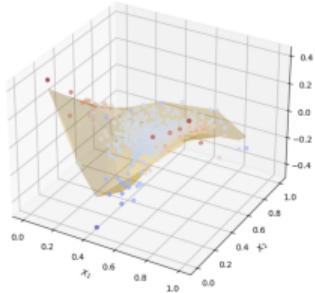
Residuals for Frac = 0.2



3D Residuals Plot for LOESS with Different Fractions

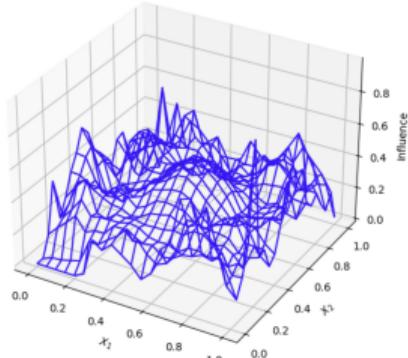


Residuals for Frac = 0.8

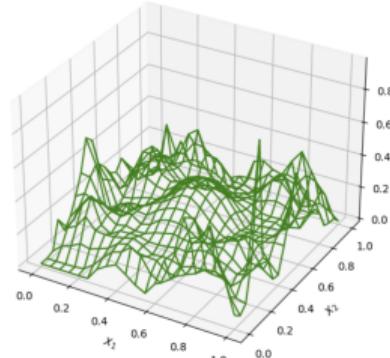


Influence and Variance Functions for Local Degree-1 LOESS with Bandwidth 0.2

Influence Function (Degree = 1, Bandwidth = 0.2)

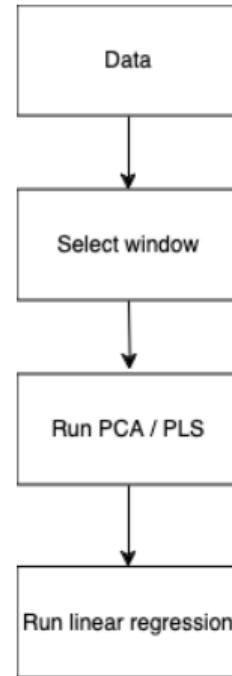


Variance Function (Degree = 1, Bandwidth = 0.2)



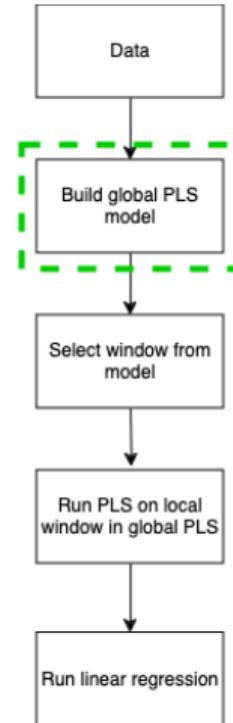
# Problems with higher dimensional data

- ▶ Multicollinearity still an issue
- ▶ PCR and PLSR still works [1, 3]
- ▶ Usually implemented as JIT systems [1]



# LPLS-S to save on computing

- ▶ First run global PLSR with many components
- ▶ Perform algorithm on new compressed dataset
- ▶ Significant speedup for low accuracy cost [3]



# Sources I

- [1] Koji Hazama and Manabu Kano. "Covariance-based locally weighted partial least squares for high-performance adaptive modeling". In: *Chemometrics and Intelligent Laboratory Systems* 146 (Aug. 2015), pp. 55–62. ISSN: 0169-7439. DOI: 10.1016/j.chemolab.2015.05.007.
- [2] Sigvald Marholm. *Localreg*. GitHub repository. URL: <https://github.com/sigvaldm/localreg> (visited on 09/10/2024).
- [3] Guanghui Shen et al. "Local partial least squares based on global PLS scores". eng. In: *Journal of chemometrics* 33.5 (2019). ISSN: 0886-9383. DOI: 10.1002/cem.3117.