Flowering date prediction for bulbous perennials

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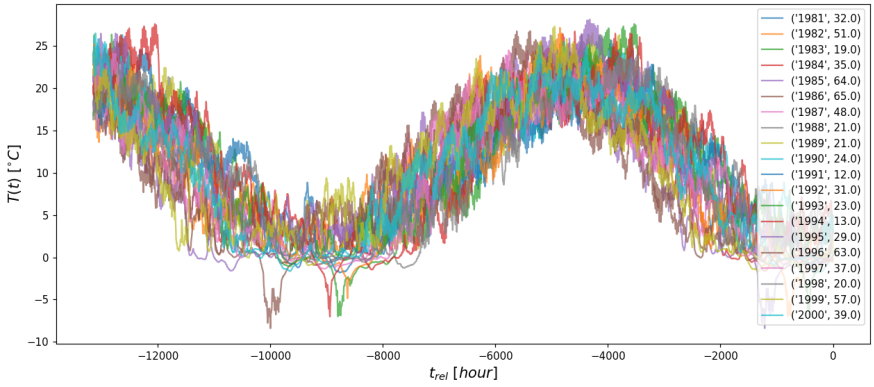
Abstract

The goal of this project is to efficiently predict the first flowering date of bulbous perennials and to identify, which meteorological parameters affect the flowering dates. The LSCD model is briefly presented, and the hyperparameters of the simpler LSC model are fitted using Gaussian process optimization. A neural network approach for the prediction of flowering dates is presented.

Introduction



The LSCD model

$$\frac{\mathrm{d}\nu}{\mathrm{d}t} = p_\nu(L,S,C,D) - s_\nu \nu \tag{1}$$

$$\frac{\mathrm{d}V}{\mathrm{d}t} = s_\nu \nu - d_V V \tag{2}$$

$p_\nu(L,S,C,D) = L \cdot S \cdot C \cdot D$ is the productive transcription, s_ν is the splicing rate, and d_V is the degradation rate of the spliced VIN3.

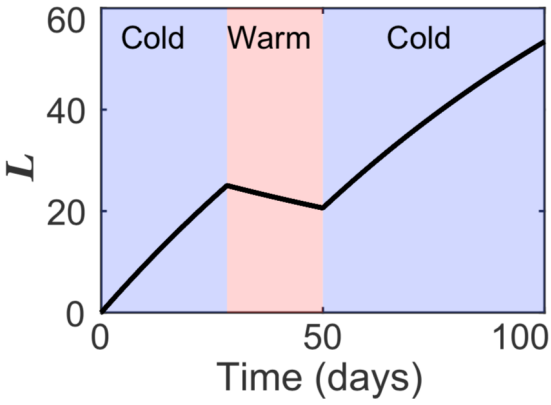
$$\frac{\mathrm{d}L}{\mathrm{d}t} = \begin{cases} 1 - d_L L & T < T_L \\ -d_L L & T \geq T_L \end{cases} \tag{3}$$

$$C(T) = \begin{cases} p_{c1} & T \leq T_{c1} \\ p_{c1} - p_{c2}\frac{T - T_{c1}}{T_{c2} - T_{c1}} & T_{c1} < T < T_{c2} \\ p_{c2} & T \geq T_{c2} \end{cases} \tag{4}$$

$$S(T_m) = \begin{cases} 1, & T < T_S \\ S_1, & T \geq T_S \end{cases} \tag{5}$$

$$D(t) = \left[p_D + \sin\left(2\pi \left(t - \frac{t_m - 1}{24} \right) \right) \right]^2 \tag{6}$$

T_m is the maximum temperature since the last resetting, which was chosen to occur each day at 4pm. t_m is the time at dawn.



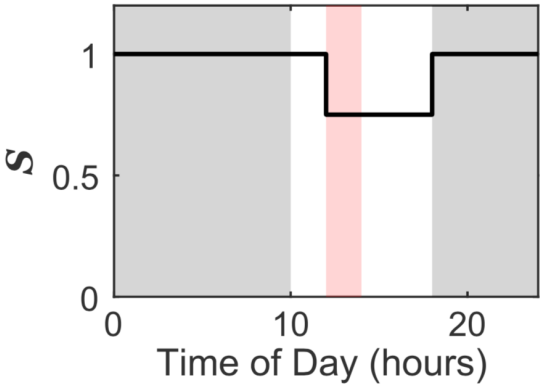
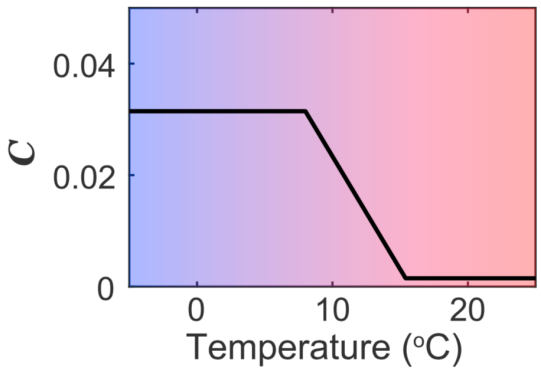
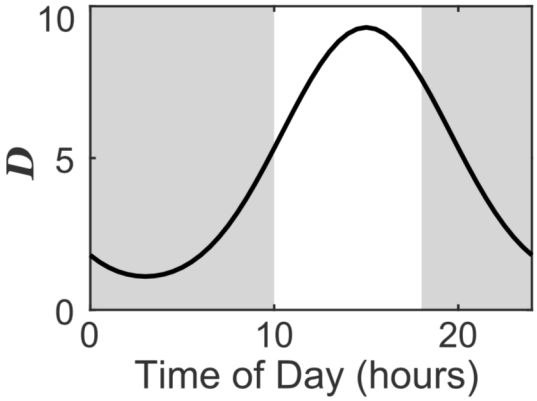
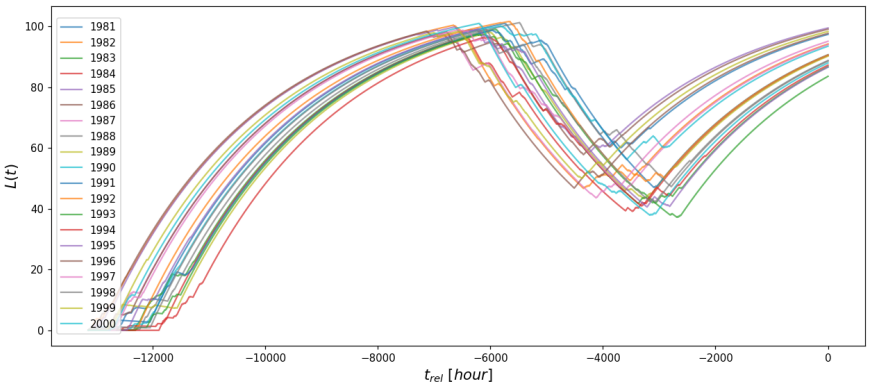


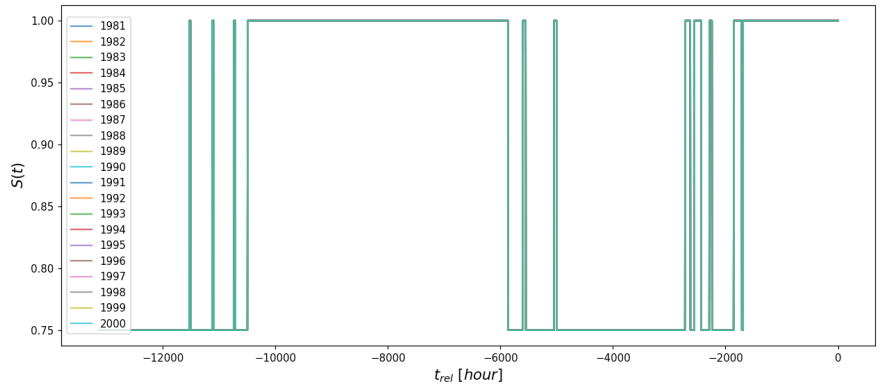
Figure 1: L intermediator for a





Results with the LSCD model

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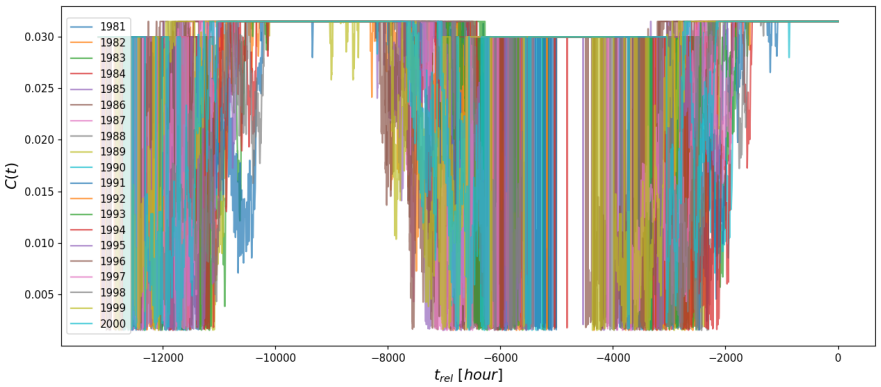
0.75
S(t)
−12000
−10000
−8000
−6000
−4000
−2000
0
t_{rel} [hour]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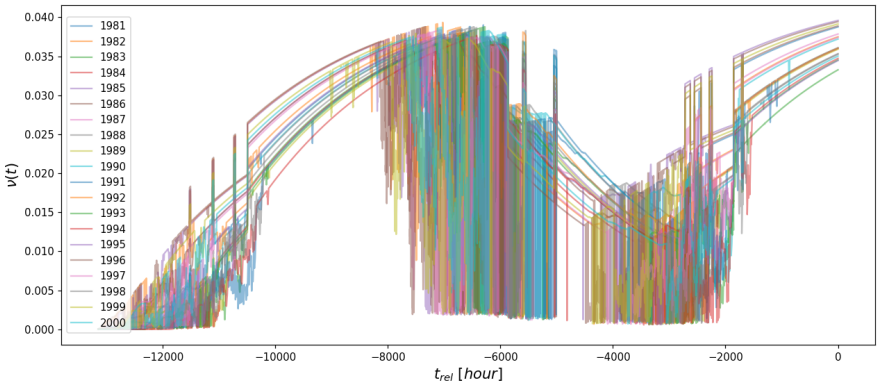
0.005
C(t)
−12000
−10000
−8000
−6000
−4000
−2000
0
t_{rel} [hour]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0.030
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0.015
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0.005
0.000
v(t)
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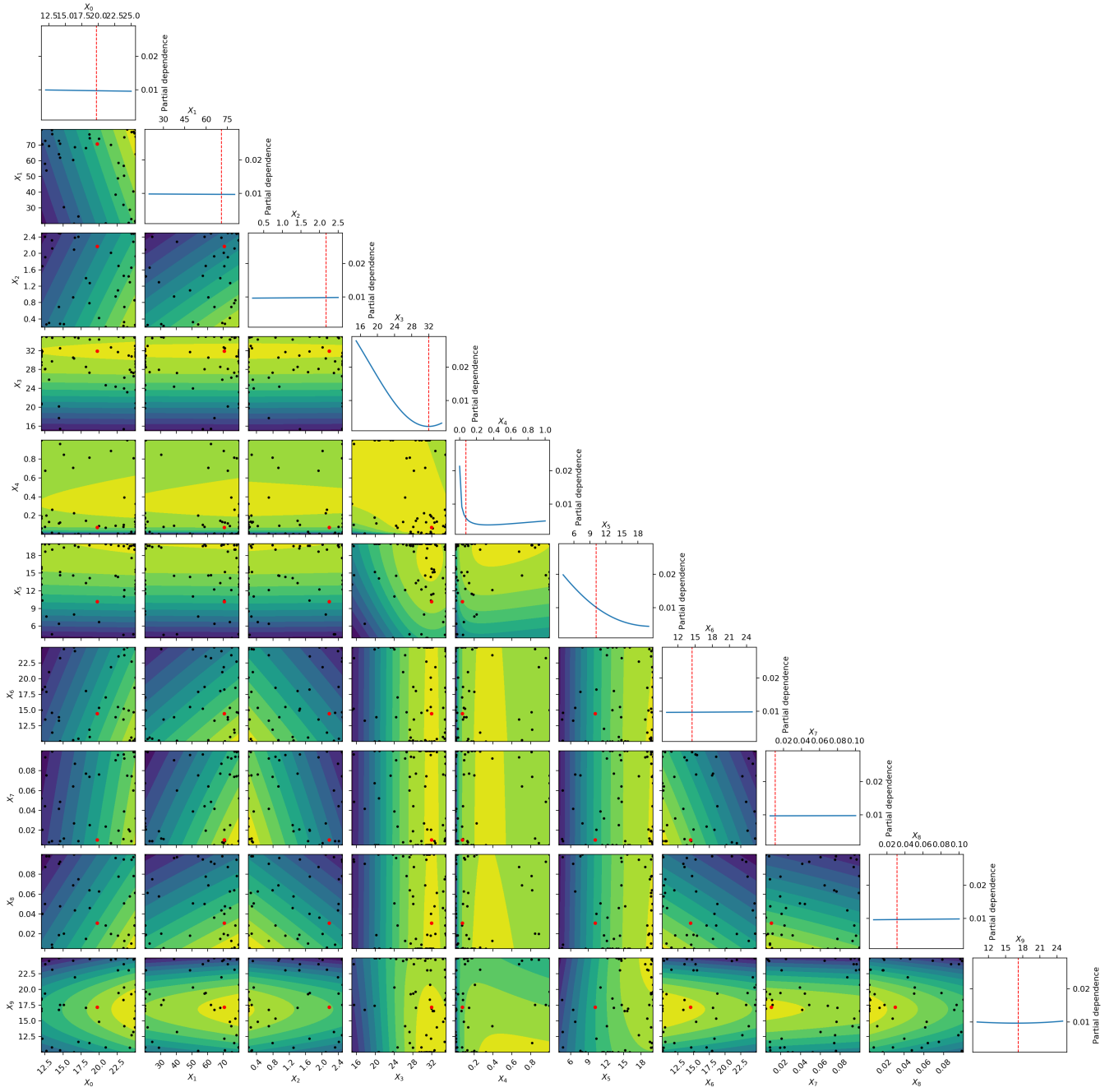
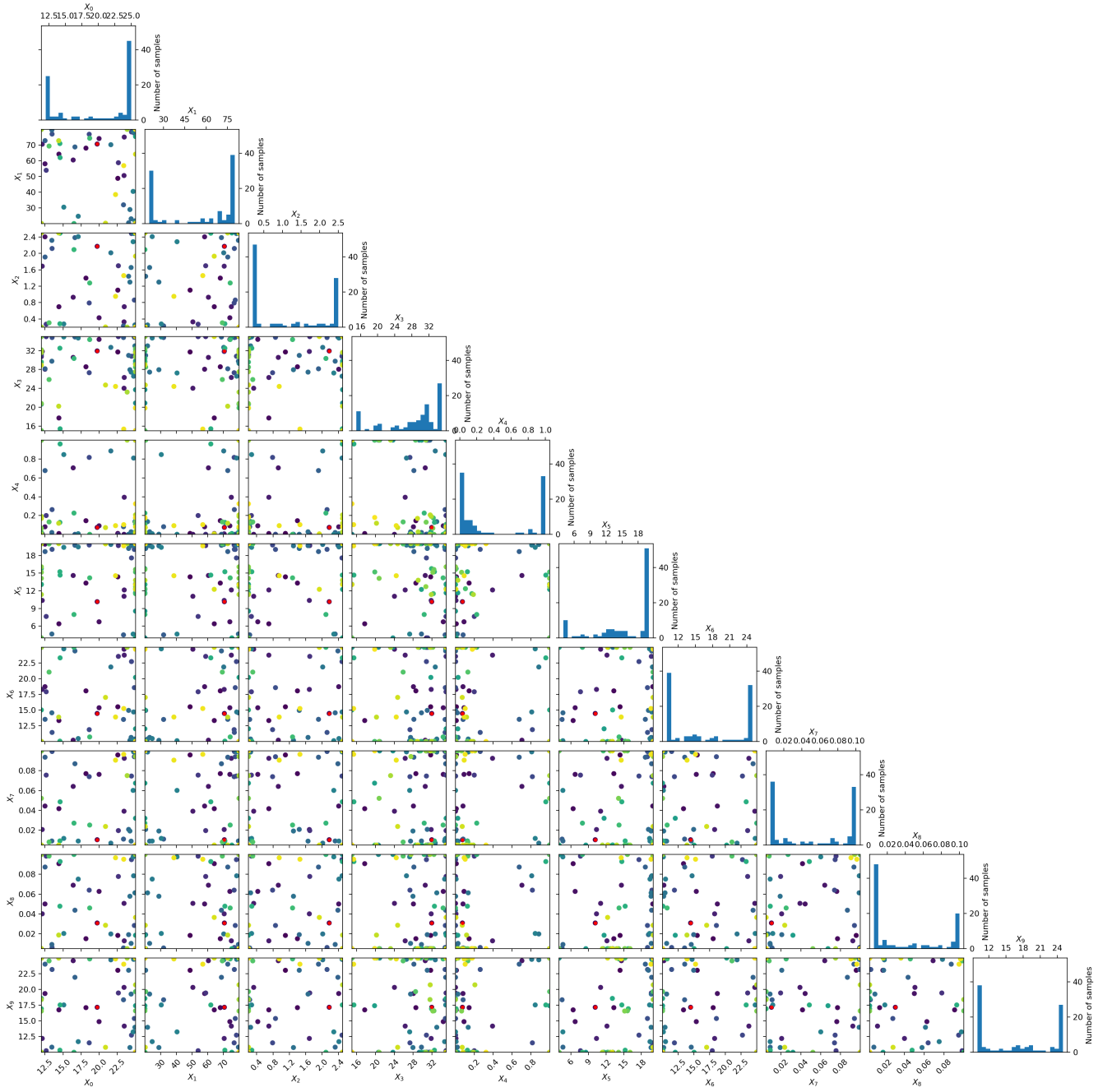
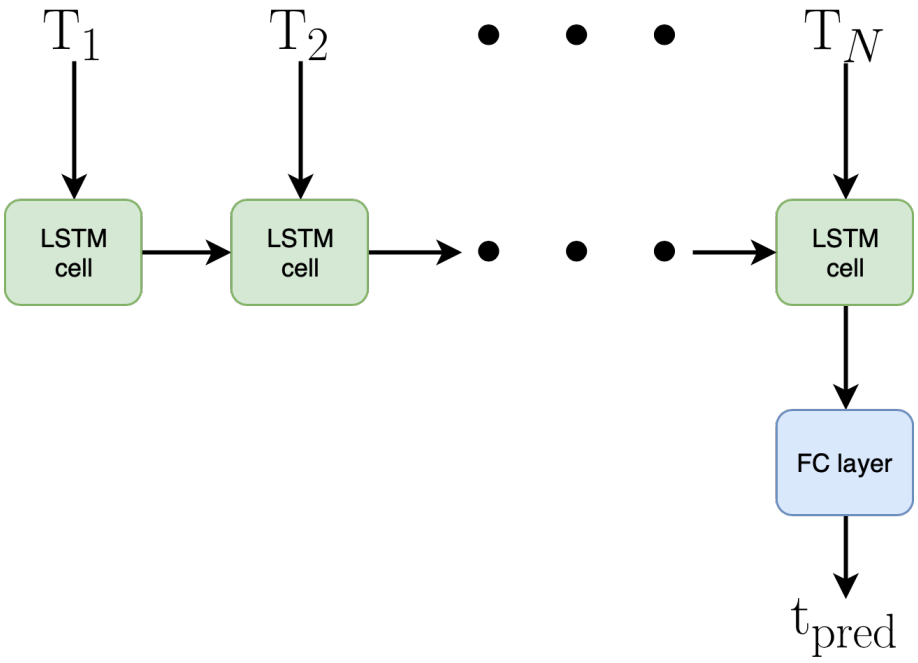
−10000
−8000
−6000
−4000
−2000
0
t_{rel} [hour]


X_0
X_1
X_2
X_3
X_4
X_5
X_6
X_7
X_8
X_9
Partial dependence


X_0
X_1
X_2
X_3
X_4
X_5
X_6
X_7
X_8
X_9
Number of samples

Neural network approach



Results of the neural network approach