A Platform for Classifying Melanoma

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Summery

Motivations:

- Enhance AI[1] knowledge.
- Automation as way to democratize access to research and AI solutions.
- CAD[2] system are promising path towards medical automation.

[1] Artificial Intelligence.
[2] Computer-Aided Diagnosis.

Objectives:

- Gain expertise in deep learning theory and its real-world applications.
- Explore and study the optimal approach for utilizing the distribution of dermoscopy images from the dataset during the training process.
- Propose and train deep learning models using transfer learning on ISIC[3] Challenge melanoma images.
- Create a CAD infrastructure with trained models, a user-friendly web UI[4], a HTTP API[5], and Docker support for easy deployment on Linux systems.

[3] Skin Imaging Collaboration.
[4] User Interface.
[5] Application Programming Interface.

Problem:

Ethical Concern:

Regulatory Framework:

Solution:

Tools:

The TS fuzzy model can be justified by:

- Its simplicity
- Uncertainties
- Its acceptable accuracy
- ....

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The system can be modeled as:

$$\begin{cases} {}^{C}D^{\alpha}x(t) = f(x(t), x(t-\tau(t)), u(t)),\ t \geq 0, \\ x(s) = \varphi(s),\ s \in [-\tau, 0] \end{cases}$$

$x(t) \in \Re^n$ the system state
$u(t) \in \Re^m$ the control vector
τ: the delay

System behavior without controller

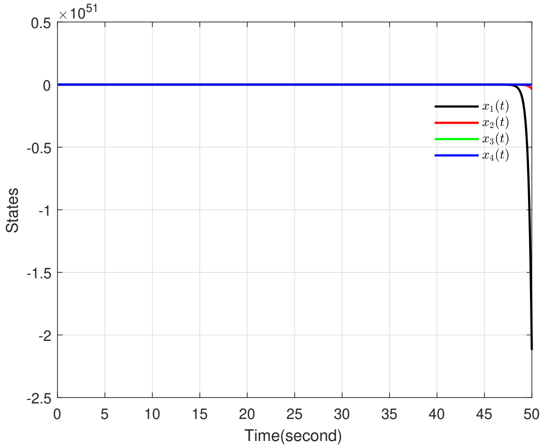

Figure 1: System state

System unstable

System behavior with controller

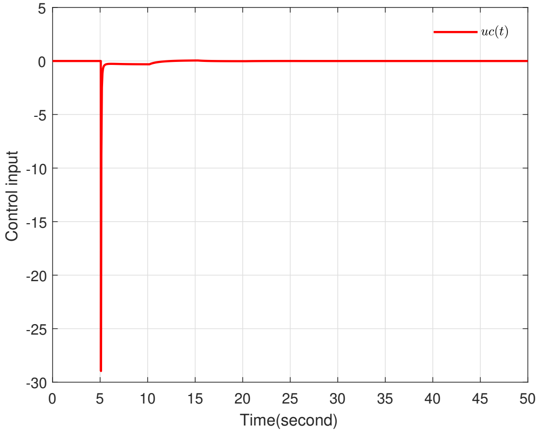

Figure 2: Control signal

System behavior with controller

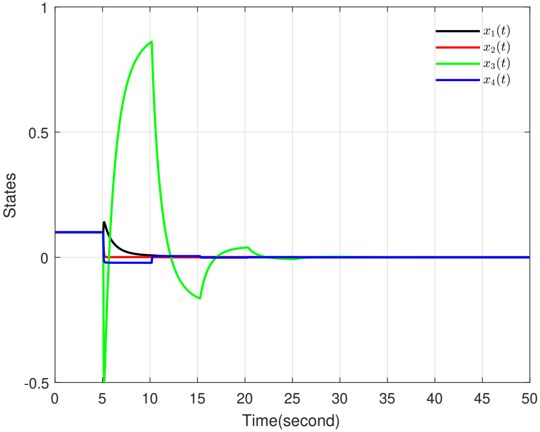

Figure 3: System state

The system is stable but it needs more enhancement

System behavior with the proposed controller

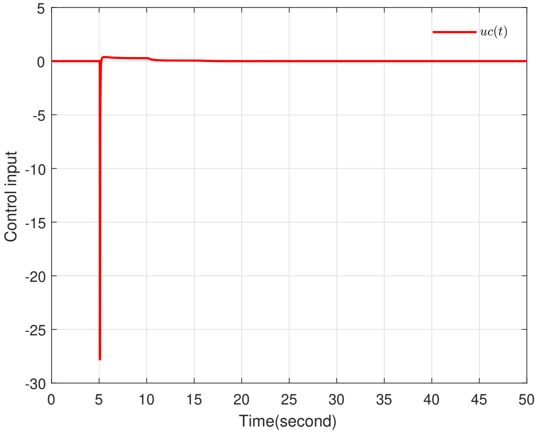

Figure 4: Proposed controller signal

System behavior with the proposed controller

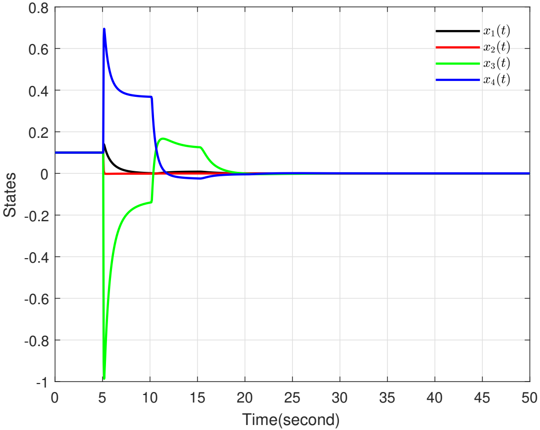

Figure 5: System state with the proposed controller

Stability + better performance

Quantification of the comparative study

	Classical controller	Proposed controller	Enhancement rate
Settling time	26	20	23 %
Pic to pic x_3	1.36	1.16	15 %
$\int_0^{ts} (x_3^2)dt$	2.5540	0.7771	70 %
$\int_0^{ts} (u^2)dt$	12.8476	7.1868	40 %

Table 1: Quantification of the comparative study

We remark that

- **Enhancement of the settling time of** 23%
- **Reduction of the control energy by** 40%
- **Overall enhancement by** 70%
- **Pic to pic reduction by** 15%

We conclude that:

Conclusion

- **Lyapunov method efficiency.**
- **Proposed controller leads to better performance.**
- **Delayed controller enhances the performance.**
- **Proposed approach allows reduction of the control energy.**

As perspectives we propose:

perspectives

- Perspective 1.
- Perspective 2.
- Perspective 3.