Determining Optimal Decision-Making Sequence for Castrip® Startup Process

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Abstract

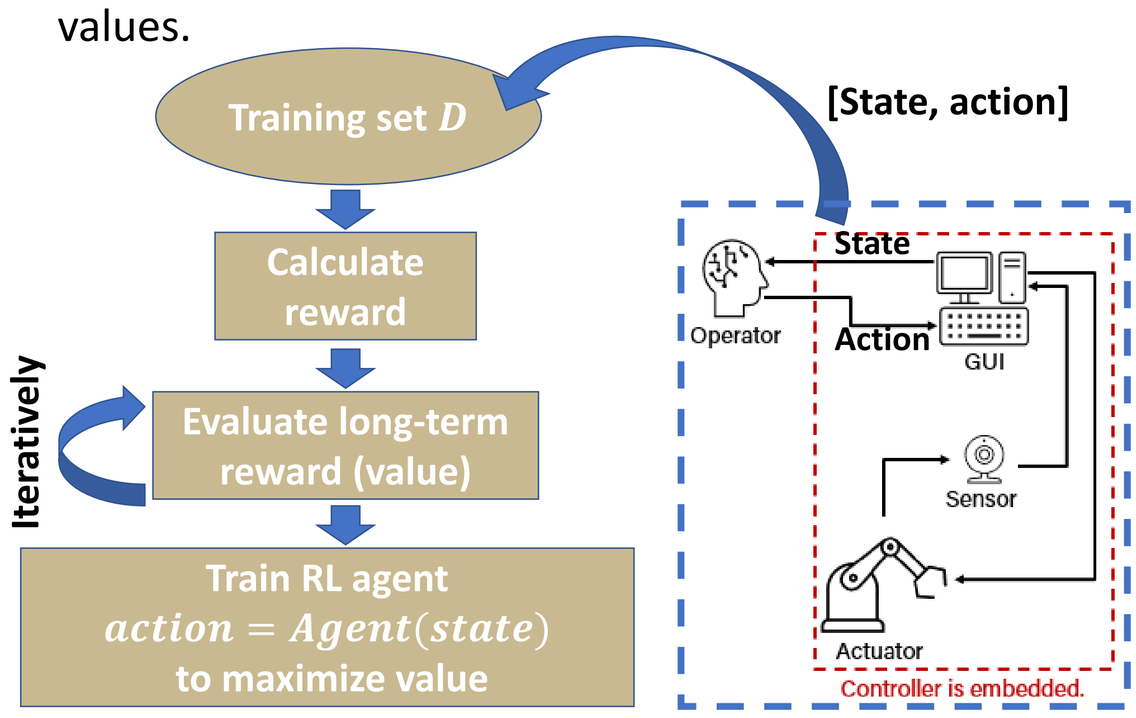
This study applies reinforcement learning algorithms to determine the optimal decision-making sequences of control references by analyzing a dataset with samples collected from Castrip startup processes driven by multiple human operators and with different control strategies.

Motivation and Background

- Casting process startup requires human operators to sequentially adjust multiple control references to meet certain control objectives.
- Reference adjustments highly depend on the plant feedback, and operators may have different strategies to adjust those control references.
- For a dataset with multiple strategies, it is challenging to determine the optimal control strategy by applying an imitation control, and thus, reinforcement learning (RL) algorithms are introduced.

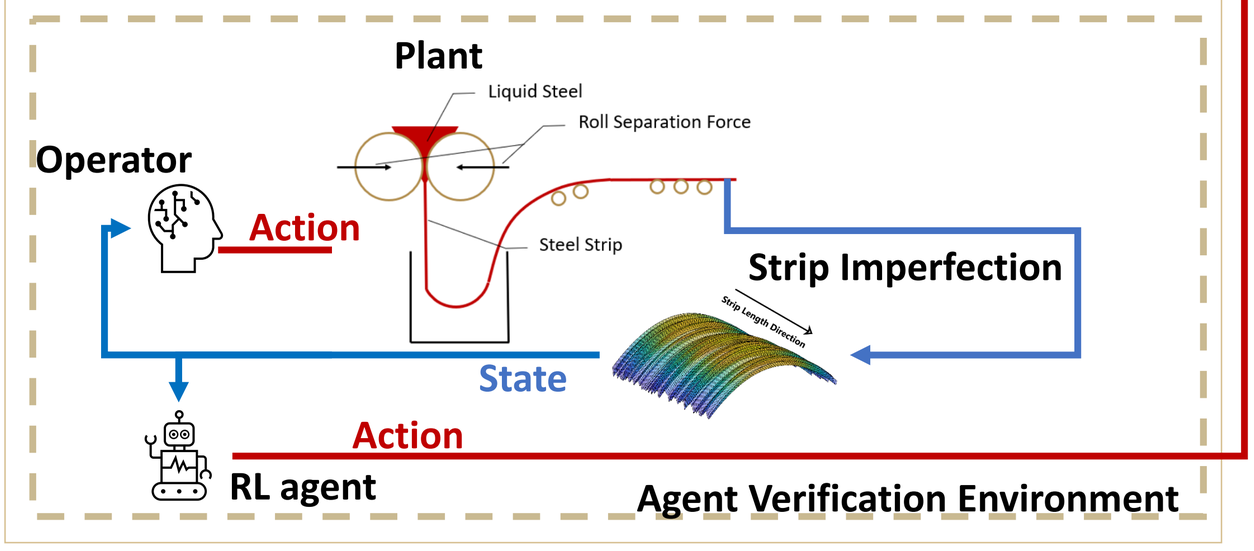
Approach or Methodology

- States and actions driven by different control strategies are collected.
- Consequences of taking certain actions under given states are represented by “values”.
- RL agents are trained to follow strategies results in high values.



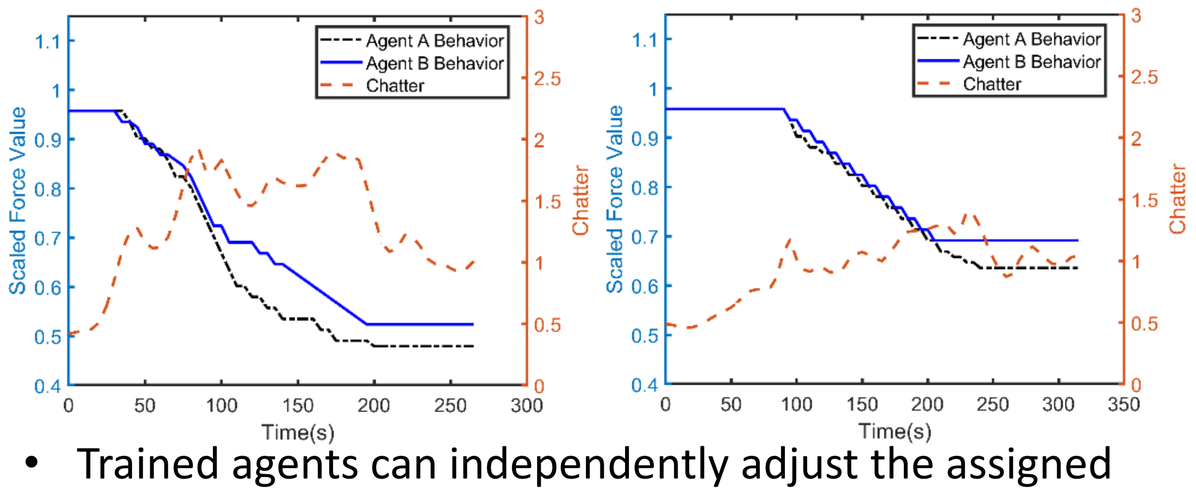
Experimental Setup

Agent performance is evaluated through 1) feeding the RL agent with the same state information as human operators observed, and 2) comparing the action done by human operators and the action suggested by the RL agent



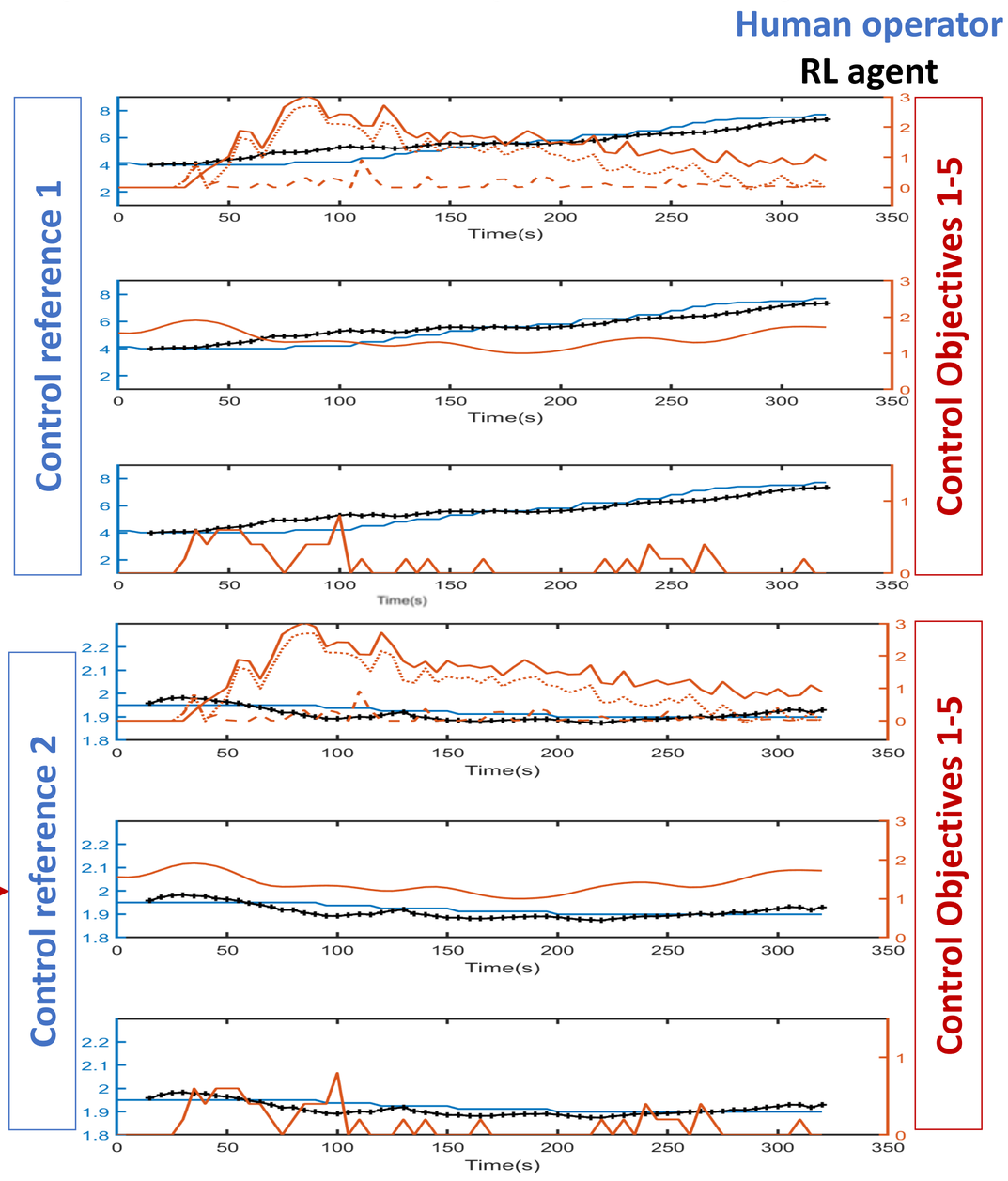
Preliminary Experimental Results

Single reference, single control objective



- Trained agents can independently adjust the assigned control reference.
- Trained agents also show behavior sensitivities to the control objective.

Multiple references, multiple control objectives



- Trained agents can independently adjust the assigned control reference.
- Trained agents also show behavior similarity to the human operator’s behavior.

Acknowledgements

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