

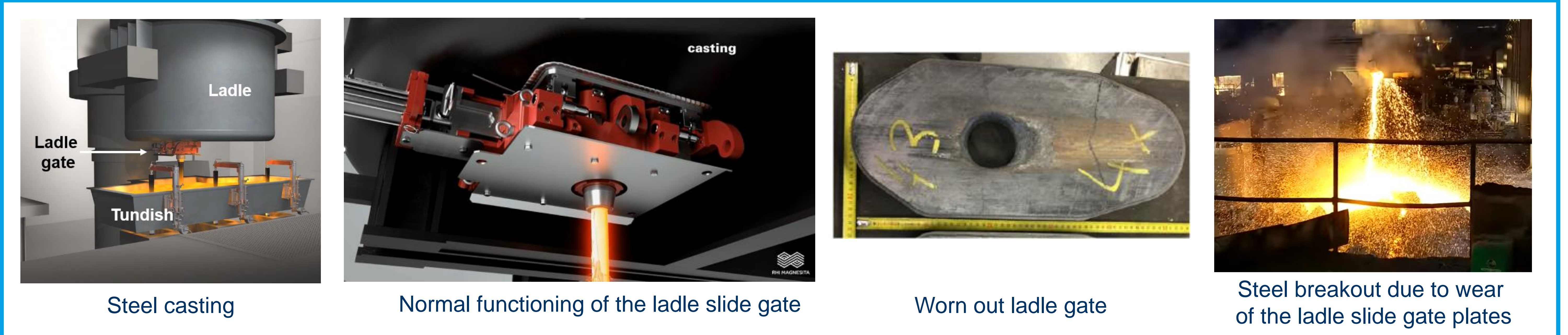
Health status monitoring of ladle gates in steel plants.

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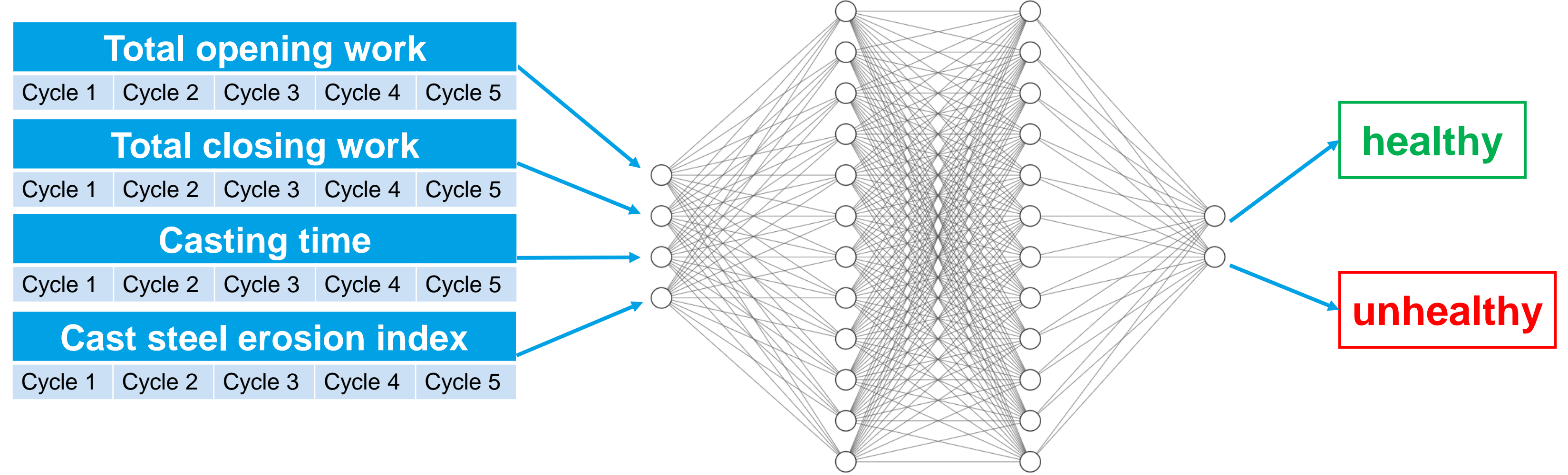
Steel infiltrations in ladle gate and/or breakouts of liquid steel occur occasionally in continuous casting leading to severe safety issues and large production loss in steel plants. These hazards can be due to the malfunction of the refractory plates of the ladle slide gate. Today's standard of their maintenance relies totally on the visual inspection of an operator, thus on his experience, training, and alertness in rough environments. In order to avoid steel breakouts, the lifetime of these plates is most often underestimated, leading to a waste of material and resources. Conversely, in rare cases hazards occur before the ladle gate is replaced. Our objective is to provide a continuous automated health monitoring system for the refractory plates of the ladle slide gate. This system will improve safety by preventing steel infiltrations and breakouts, will reduce refractory costs and Co2 emissions by increasing number of safe uses per plate and will improve casting process stability and production planning.

The problem



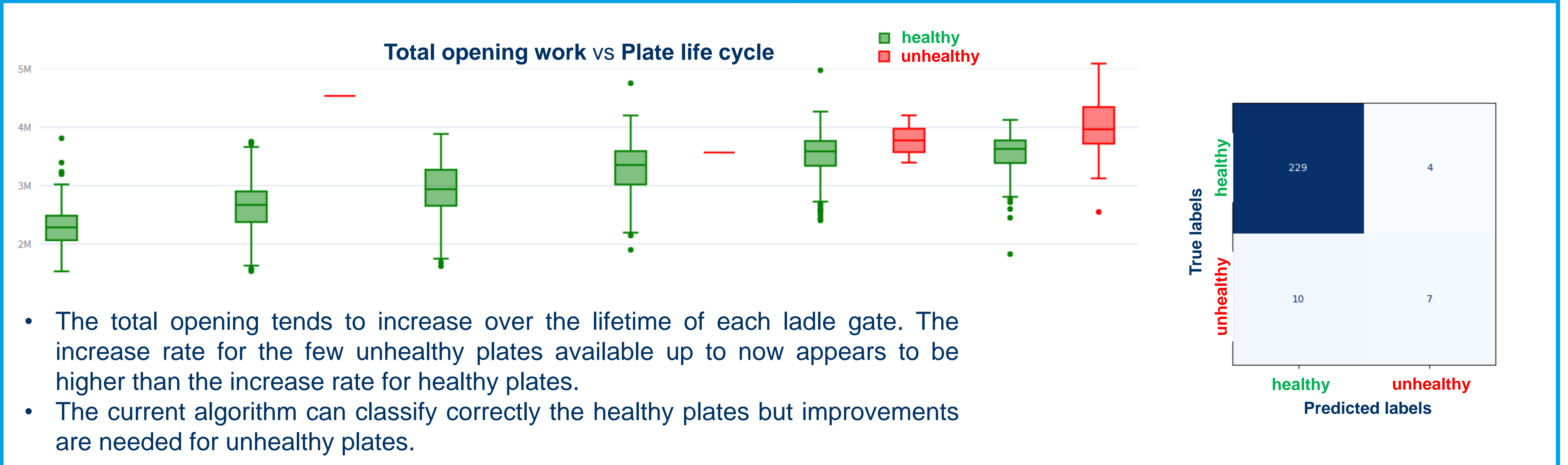
Methods

Assumption: plate wear can be detected from anomalies in the functioning of the hydraulic cylinder responsible for the opening and the closing of the ladle gate.



- The position and pressure of the hydraulic cylinder responsible for the sliding of the ladle gate plates is measured. The exerted total work during the opening and the closing phases of the gate is computed.
- The ordered sequence of opening work, closing work, casting time and erosion index throughout the ladle gate lifetime available up until the present is fed to a trained XGBoost binary classifier to predict the plate's health.

Preliminary results



- The total opening tends to increase over the lifetime of each ladle gate. The increase rate for the few unhealthy plates available up to now appears to be higher than the increase rate for healthy plates.
- The current algorithm can classify correctly the healthy plates but improvements are needed for unhealthy plates.

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