



TACTICAL DIGITAL TWIN
RL FOR FOOTBALL STRATEGY

Tactical Digital Twin in Football

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Problem introduction

Modern football analysis fails to objectively evaluate the complex, real-time tactical contribution of players on the pitch.

Our project delivers a Tactical Digital Twin solution that uses advanced reinforcement learning and self-play to discover and optimize next-generation football strategies.



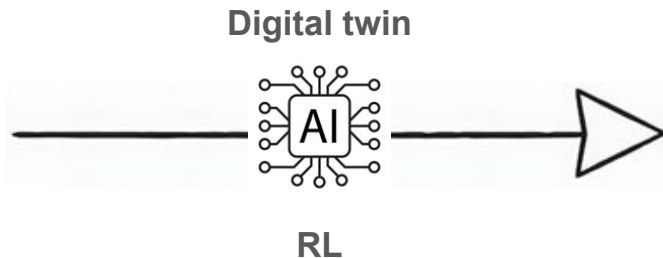
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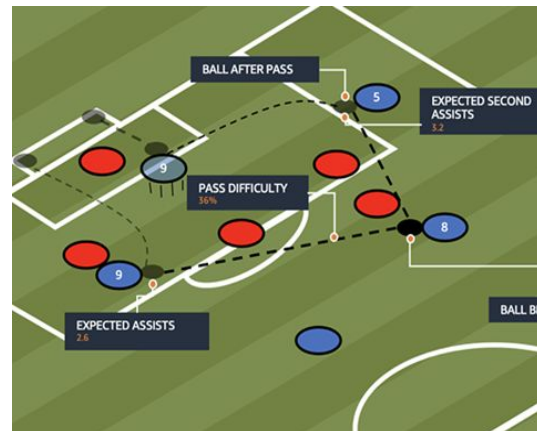
'What happened'



Descriptive analytics



'What can happen'



Predictive & Prescriptive analytics

Value proposition

This project supports **Goal 9 (Industry, Innovation, and Infrastructure)** by promoting cutting-edge AI applications in the sports engineering sector, helping to improve infrastructure and innovation in performance optimization technologies.

Target 9.5: Enhance Research and Upgrade Industrial Technologies.

Target 9.4: Upgrade All Industries and Infrastructures for Sustainability.





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Objectives



Develop a reproducible framework (digital twin) under realistic constraints, using real or synthetic data



Apply AI techniques to **simulate and optimize tactical behaviors**



Integrate real tracking or event data for **validation and calibration**



Design evaluation metrics to assess tactical effectiveness and realism

Stakeholders



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Michael J. Andersen

Head Coach

Former Midfielder; UEFA Pro License
15 Years of Coaching Experience

User Persona



GOALS

- Build a consistent tactical identity
- Make confident, evidence-based match decisions
- Improve team organization in pressing, build-up, transitions

NEEDS

- Clear interpretation of match performance
- Automatic recognition of tactical patterns
- Coach-friendly visuals for team briefings
- Quick evaluation of alternative tactical choices

FRUSTRATIONS

- Tactical insights take too long to extract from matches
- Hard to connect raw data to clear, actionable coaching decisions
- Limited time to explore alternative tactical options

Michael's Journey



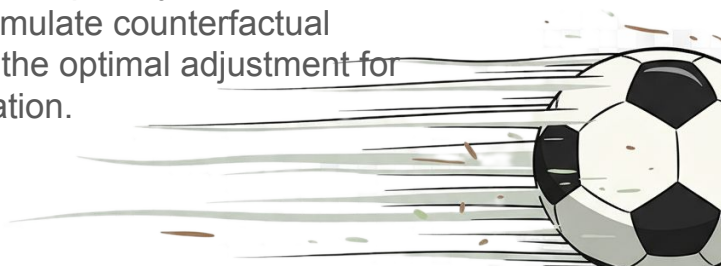
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Michael searches for tools capable of connecting raw data to clear decisions, but it's not easy to find a platform that offers quick quantitative validation of alternative tactics.

Michael exploits the evidence-based results to make a confident decision and uses the clear, coach-friendly visuals to drive team briefings, boosting player compliance and loyalty to his strategy.

Michael is frustrated after a key match loss, he gathers insights on his high-press failure, but the manual data is exhausting, and the conclusions are often inaccurate and not actionable.

Michael decides to use a new analysis system, reportedly being developed by Politecnico di Torino, to rapidly simulate counterfactual scenarios and test the optimal adjustment for his team's organization.



User Requirements



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FUNCTIONAL

NON-FUNCTIONAL

Mo

MUST HAVE

Quantify: the system must simulate and generate quantitative results on the effectiveness of alternative tactical choices and counterfactuals.

Robustness: the system must demonstrate robustness by operating reliably across different datasets, tactical scenarios, and execution conditions, ensuring that core functionalities remain stable even when inputs or environments vary.

S

SHOULD HAVE

Visualization: the system should visualize simulated scenarios and key performance indicators in a coach-friendly format for easy presentation in team briefings.

Usability: The system should offer Clarity through an intuitive interface and coach-friendly visuals for quick interpretation and effective team briefings.

Co

COULD HAVE

Optimize: the system could adjust decision models, and provide parameter tuning tools to optimize tactical behaviors.

Adaptation: the system could adapt to different tactical styles, data conditions, or evolving project goals, remaining useful as new strategies, behaviors, or analysis needs emerge.

W

WON'T HAVE

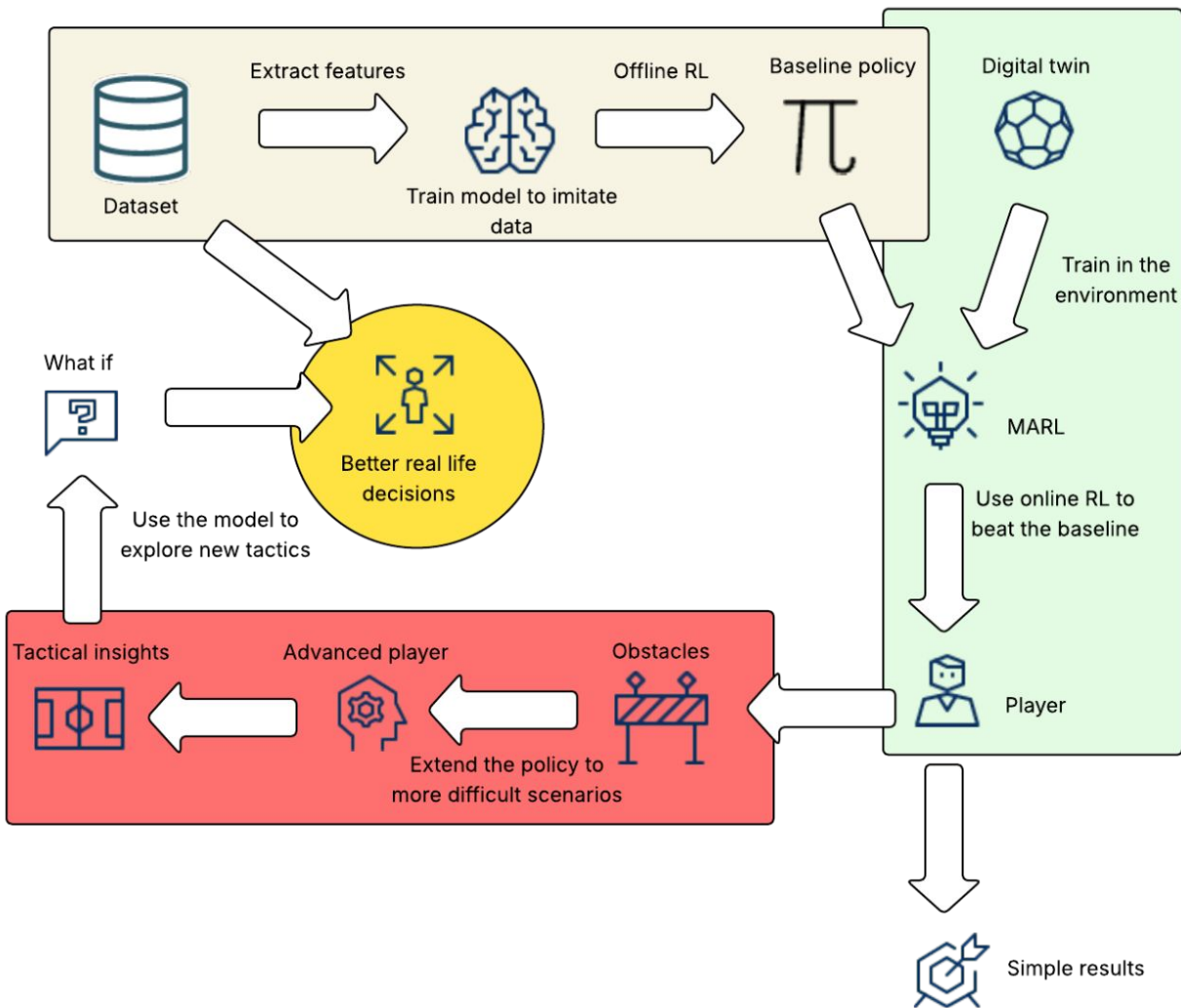
Analyze: the system won't offer real-time race strategy recommendations, focusing only on analyzing completed scenarios.

Exclusion: the system won't include physiological modeling, sports medicine features, or other non-essential components unrelated to tactical simulation.



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Functional Diagram





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Work breakdown structure

WP No.	WP Title	Lead Name	PM	Start Month	End Month
1	Project Management	M	0.5	November	November
2	Research	A	0.5	November	November
3	Data and Environment exploration	L	0.75	November	December
4	RL offline model	M	1.5	November	December
5	MARL online model	A	1.5	November	January
6	Documentation	L	0.5	November	January

Thank you !



**Politecnico
di Torino**



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