

PHMAP'23  phmsociety

Prognostic Discriminator under Uncertainty

Civil Engineering domain

3 sessions and 10 titles

<https://phmap.jp/submission-os-list/>

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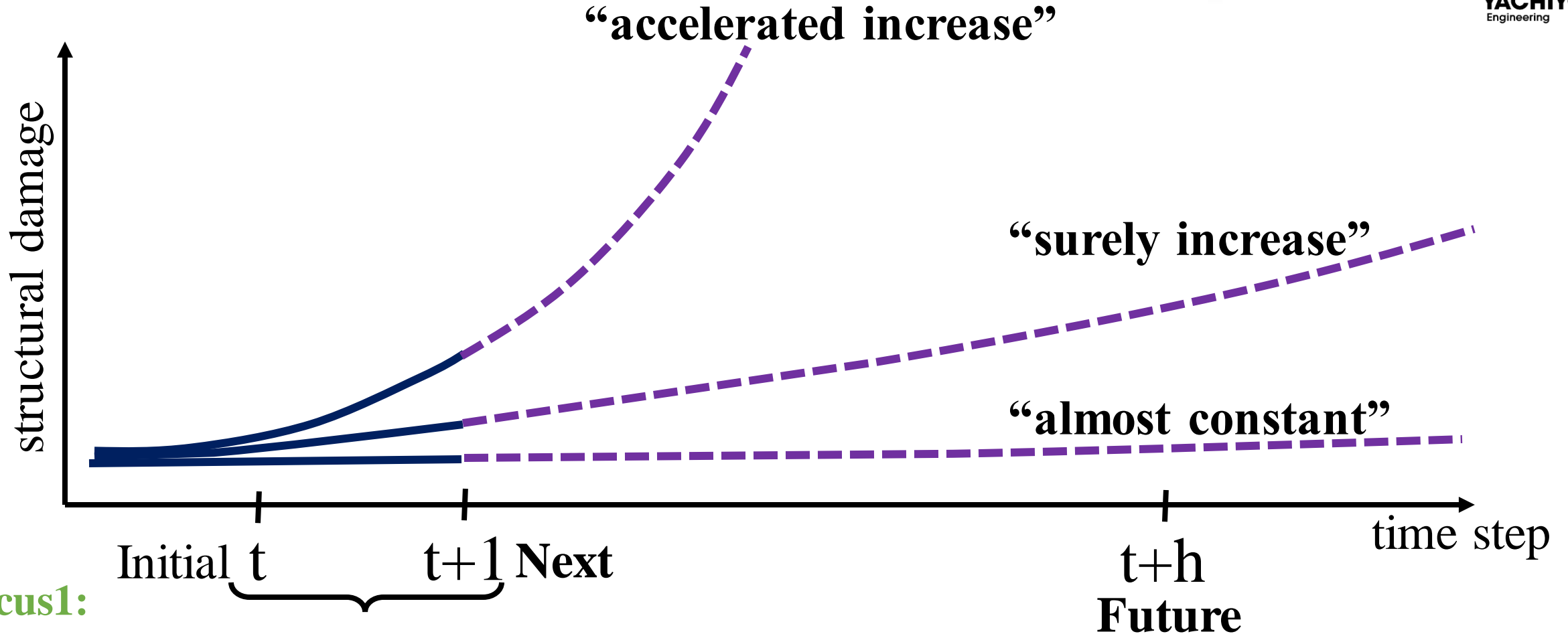
Organizer Takato YASUNO

Prognostic Discriminator under Uncertainty

— Recognition technology of prognostic change in civil engineering to respond to uncertain environment —

- Our standard of living has been in the midst of weather crisis such as heavy rains and droughts. In the construction domain, the aging and declining workforce has become problematic. Therefore, it is essential to continuously use existing civil and architectural structures which support daily activities in urban and rural areas.
- According to the refinement of BIM/CIM design information, and data acquisition from drones and surveillance cameras inspections task for diagnosis and prognosis has been improved using computer vision and robotics. These technologies have made it possible to recognize surface damage and detect structural deformation at a single point in time.
- However, the methodology for multi-periods of prognosis systematically and continuously comparing the initial and post-event states, such as capturing changes over time, has only just begun, and it is critical for making urgent and prioritized repair and renewal decision.

- In this session, as an enabler of sustainable use in the civil engineering and architectural structures, we will address monitoring the state of structures and attempt to induce innovation in science and technology that focuses prognostic changes over time.
- For example, we should consider various structures such as buildings, bridges, tunnels, railways, dams, rivers, sewers, and landslides.
- From a manager point of view, we aim to solve problems such as predictive maintenance and anomaly detection in daily inspections. In case of natural disaster, we would address earthquake/flood risk assessments, business continuity management and deterioration assessments.
- Recent digital infrastructure has been required for the prognosis of deterioration of aging structures, inspections and forecasts.
- We will collaborate on practical methodology and share experimental empirics based on prognosis support technology and optimization of repair and renewal.
- We discuss the deployment of digital infrastructure, practical technology that recognizes prognostic changes and anomalous deformation, visualization of damage scoring indicators for structural monitoring, and opportunities for research and development.



Focus1:
Multi-period Discriminator for Prognostics

Focus2: Prognostics for Uncertain Environment

Figure. Predictive Management for Multi-period Prognostics

Participants/Title in Civil Session 1: Concrete Defect

ID	Target	Participants, Affiliation	Title (words)	Connect Keyword
3455	Bridge	Takahiro Saitoh O, Gunma University	Automatic Detection of Concrete Surface Defects Using Deep Learning and Laser Ultrasonic Visualization Testing	Concrete Defect
9292	Bridge	Hitoshi Ito, YACHIYO Engineering, Co.,Ltd.	Observation Maintenance for Bridges Using Early Detection of Deterioration Progress	Concrete Defect
6224	Dam	Akira Ishii, YACHIYO RIIPS	Study on the Estimation of Concrete Defects Volume on Dam Body Surface	Concrete Defect
5571	Bridge	Kosuke Kinoshita, NEC, Co.Ltd.	Outlier Analysis of Bridge Deflections Using Satellite SAR & Structural Simulation : Case Study on Collapse Accident in Water Pipe Bridge in Japan	Concrete Defect

Participants/Title in Civil Session 2: **Damage Detection**

ID	Target	Participants, Affiliation	Title (words)	Connect Keyword
3900	Railway	Takato Yasuno O, Masahiro Okano, Junichiro Fujii, YACHIYO RIIPS	Wooden Sleeper Deterioration Detection for Rural Railway Prognostics Using Unsupervised Deeper FCDDs	Damage Detection
7461	Road	Masato Tsuchiya, Ken Miyamoto, Yasushi Sugama, Mitsubishi Electric, Co.	Road Infrastructure Maintenance through Anomaly Detection in Drive Recorder Images	Damage Detection
0131	Road	Yuta Shirakawa, Satoshi Ito, et al., TOSHIBA Co.	Automating Daily Inspection for Expressways Using Anomaly Detection Model	Damage Detection

Participants/Title in Civil Session 3: Digital Twin

ID	Target	Participants, Affiliation	Title (words)	Connect Keyword
7529	Building	Yasutaka Narazaki O, Zhejiang University	Digital Twin of Built Structures assisted by Computer Vision Techniques : Overview and Preliminary Results	Digital Twin
2733	Road Railway	Antonio J. Guillén López, Juan Fco. Gómez Fernández, et al. University of Seville (Spain)	Experimental Platform for Digital Twin Development in Railway Maintenance	Digital Twin
4399	Road Railway	Tomoya Abe, Nakasha Creative, Co.Ltd.	Efficient Inspection of Civil Engineering Structures for Railways and Roads Using Images and GNSS	Digital Twin

Target Structure	Keywords for Multi-period Discriminator	Prognostics for Uncertain Environment
City Zone	Satellite imagery, multi- / hyper-spectral band mapping, Normalized Difference X(Vegetation /Water/Snow) Index, LULC (Land Use/Cover), change detection, GIS layer segment analysis	Urbanization forecast, Carbon reduction policy, population density, urban thermal climate, local climate zone(LCZ), world urban database, scenario redesign urban and rural region
Building	Drone monitoring, visual inspection, deterioration of exterior wall, floating and uneven surface, equipment anomalies	Post-quake emergency assessment, BIM structural analysis, safety diagnosis
Plaza Sidewalk	Surveillance camera, changes in people flow, congestion density visualization	Visualize living environment, safety of gatherings, emergency response measures
Railway	Mobile on-board camera, bolt deformation detection, early detect anomalies, signal of equipment failure	Railway track maintenance, predictive maintenance, level of service, management of trackside planting
Tunnel	Surveillance camera, prevention/removal of delamination/peeling, early detect of deterioration	Vehicle safety management, prevention of third-party injury, groundwater influence, backside cavities in lining

Note. The abovementioned keywords are not limited, so new ideas, methodology and experimental lessons are fine to submit to any paper for Civil Engineering prognostic.

Target	Keywords for Multi-period Discriminator	Prognostics for Uncertain Environment
Bridge	Early deterioration, drone monitoring, safe visual inspection on elevated area, non-destructive survey, crack, exposed rebar, corrosion	Predictive maintenance, latent/extensive stage, degradation factors, coastal salt damage, frost damage, vehicle load, sedimentation, fatigue
Dam	Drone monitoring, autonomous flight in high area, displacement from the initial stage, early detect of deformation	Initial condition at completion stage, CIM, safety diagnosis, predictive maintenance
River	Surveillance camera, management indicator of water surface condition, visualize river environment	River environment preservation, water quality, odor, river landscape, chemical measure decision support
Road	On-board camera, road surface, asphalt damage detection, surveillance camera, visualize hazardous vehicle flow lines, emergency alerts	Anomaly detection and removal of falling objects, planning repair measure, synchronization of section construction, accident prevention at intersections, rehabilitation design
Landslide	Condition monitoring before/after heavy rain, risk/emergency assessment of landslide, near real time satellite monitoring	Slope preservation, avoidance of third-party injury, preliminary area hazard assessment



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