Artificial Intelligence in Mitigating Dam Related Challenges

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Dams in Promoting Economic Development

Dams allow to control flowing water and use it for multiple purposes, such irrigating agricultural land, supply water to urban population, generate electricity, prevent floods, mitigate droughts, promote navigation and enhance tourism

Globally, dams generate 16% of the world's electricity and irrigate lands that produce food of 12-15% of the global population.

Therefore, it is a vital hydraulic structure to promote economic development and social well-being

Dam Related Challenges

- Dams often cause resettlement of large amount of population
- It reduces freshwater species (37% declines during 1970-2008)
- Reservoirs emits methane (nearly 4% of total global emission)
- Cause river sedimentation and changes of water temperatures change
- Soil erosion in the downstream and negative effects to ecology.

Climate Change Challenges to Dams

- Increased climatic extremes and dam failure risk
- Changes in precipitation pattern and increased sedimentation in reservoir
- Changes in reservoir inflow and water demand, and thus, more frequent adjustment of operating rule
- Changes in the frequency, duration, and timing of annual flooding events.
- Increased evaporation from reservoir due to temperature rise and negative effects on microclimates
- Change in river composition and stress in upstream and downstream habitats.

AI in Mitigating Dam Related Challenges

- Artificial Intelligence (AI) can simulate highly non-linear process without accurate data of large amount of parameters that define the process.

- AI can be used with remote sensing and geographic information system to identify suitable dam location considering not only the hydrological and geomorphological factors, but also human settlement, ecological safety and environmental risk.

- AI can relate dam stresses and stability with hydrological parameters and predict dam safety due to the changes of hydrology, particularly in the context of climate change

AI in Mitigating Dam Related Challenges

- AI can be used to predict the likelihood of a rainfall event that may cause dam overflow and downstream damages, and therefore, development of early warning system.

- AI can be used to define dam operation rules through optimization of supply and demand for climate change scenarios and provide more economic benefits

- AI can be used to design spillway to reduce energy dissipation, and thus, soil erosion and damages in the downstream.

- AI can link dam sedimentation with elevation and hydrological data, and thus, quantify the effect of various control measurement to find the best management option

AI in Mitigating Dam Related Challenges

AI can be a solution of dam related existing challenges and the future challenges that may arise due to climate change

AI can be implemented based on observed data without estimating all the parameters required for defining the physical processes responsible for dam safety or dam operation.

Therefore, AI is the best option for mitigating dam related challenges in the region that lacks data and information and in the context of climate change uncertainties

Thank you very much