국외출장 결과보고서

국외출장 보고서

2018.12.26

KIHASA 한국보건사회연구원
Korea Institute for Health and Social Affairs

1 출장 개요

□ 출장목적

○ WSC 2018 전시회 시연 및 참석

□ 과제명

○ 점진적기계학습기반자가진화에이전트 시뮬레이션을 이용한 사회변화예측분석기술개발

□ 출장기간

○ 2018.12.08.(토)~2018.12.14.(금)

□ 출장지역

○ 스웨덴 예테보리(The Swedish Exhibition & Congress Centre)

□ 출장자

○ 오미애 연구위원, 천미경 연구원

□ 일정요약

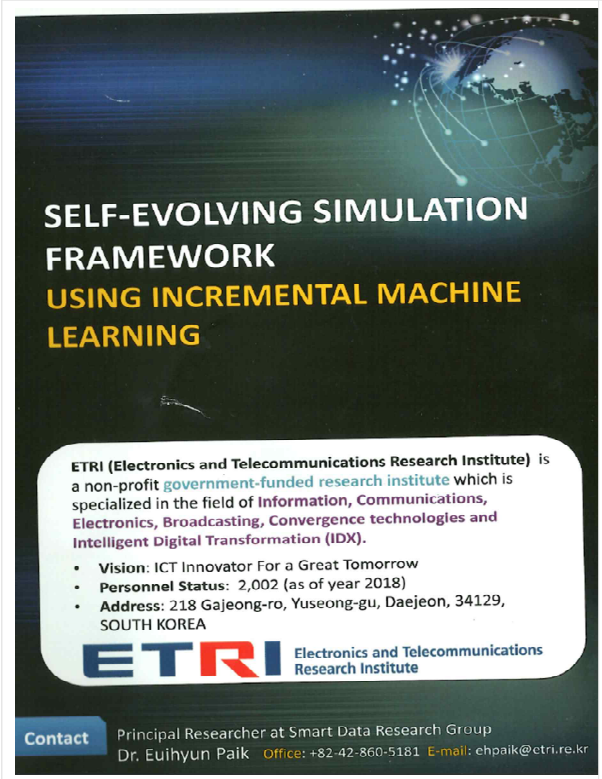
일자	국가/지역	방문기관	면담자	주요 논의사항, 습득사항
2018.12.08	인천-고텐부르크	출국		암스테르담 경유 고텐부르크(예테보리) 도착
2018.12.09	스웨덴 예테보리 (고텐부르크)	The Swedish Exhibition & Congress Centre	학회 전시회 시연	Winter Simulation Conference 2018 (1일차) 참석
2018.12.10	스웨덴 예테보리 (고텐부르크)	The Swedish Exhibition & Congress Centre	학회 전시회 시연	Winter Simulation Conference 2018 (2일차) 참석

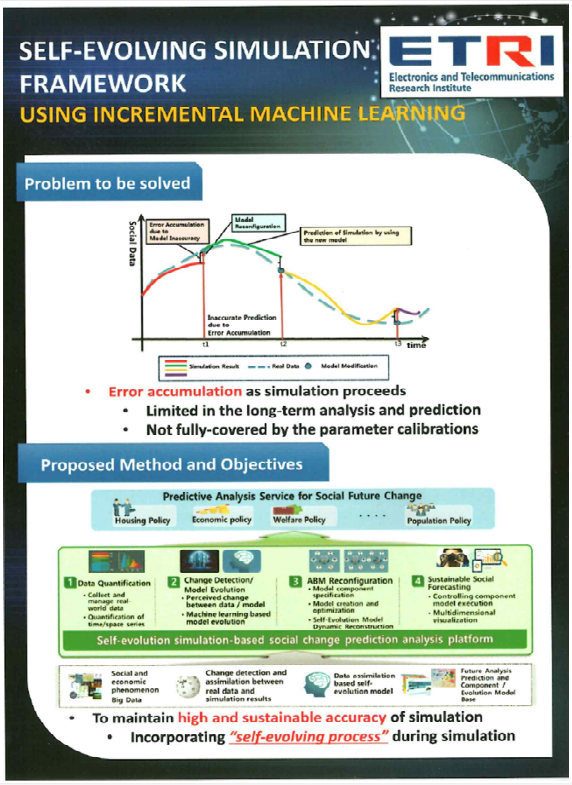
일자	국가/지역	방문기관	면담자	주요 논의사항, 습득사항
2018.12.11	스웨덴 예테보리 (고텐부르크)	The Swedish Exhibition & Congress Centre	학회 전시회 시연	Winter Simulation Conference 2018 (3일차) 참석
2018.12.12	스웨덴 예테보리 (고텐부르크)	The Swedish Exhibition & Congress Centre	학회 전시회 시연	Winter Simulation Conference 2018 (4일차) 참석
2018.12.13	고텐부르크-인천	귀국		암스테르담 경유 인천 이동
2018.12.14	인천	도착		

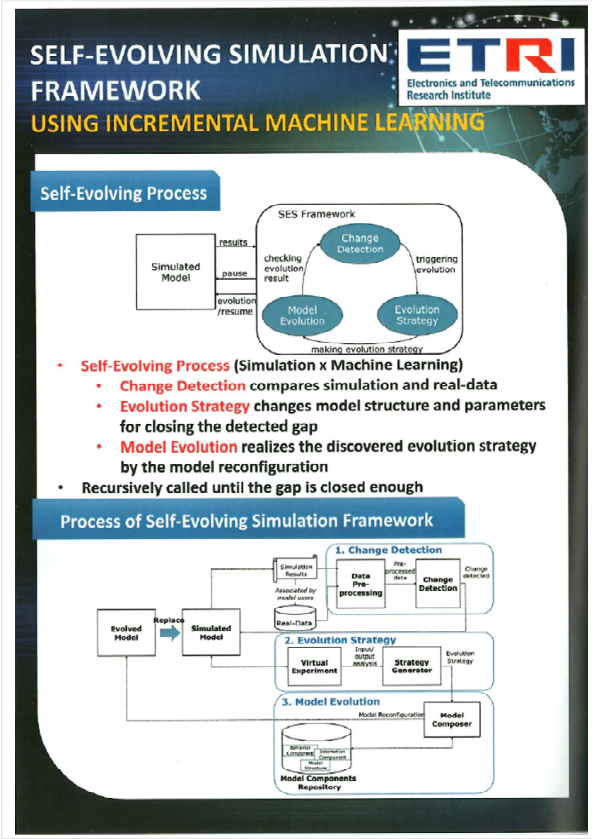
2 세부 내용

가. 과제의 연구실적 중 하나로 Winter Simulation Conference에 참석하여 자가진화 에이전트 시뮬레이션 기술, 복지 모델을 활용한 자가진화 기술을 전시 및 시연(ETRI, KIHASA)하고자 WSC2018 참석

1) 부스 시연 브로셔


SELF-EVOLVING SIMULATION FRAMEWORK
USING INCREMENTAL MACHINE LEARNING
ETRI (Electronics and Telecommunications Research Institute) is a non-profit government-funded research institute which is specialized in the field of Information, Communications, Electronics, Broadcasting, Convergence technologies and Intelligent Digital Transformation (IDX).
Vision: ICT Innovator For a Great Tomorrow
Personnel Status: 2,002 (as of year 2018)
Address: 218 Gajeong-ro, Yuseong-gu, Daejeon, 34129, SOUTH KOREA
ETRI Electronics and Telecommunications Research Institute
Contact
Principal Researcher at Smart Data Research Group
Dr. Euihyun Paik Office: +82-42-860-5181 E-mail: ehpaik@etri.re.kr


SELF-EVOLVING SIMULATION FRAMEWORK
USING INCREMENTAL MACHINE LEARNING
ETRI Electronics and Telecommunications Research Institute
Problem to be solved
Error accumulation as simulation proceeds
Limited in the long-term analysis and prediction
Not fully-covered by the parameter calibrations
Proposed Method and Objectives
Predictive Analysis Service for Social Future Change
Housing Policy
Economic policy
Welfare Policy
Population Policy
Data Quantification
Change Detection/ Model Evolution
ABM Reconfiguration
Sustainable Social Forecasting
Self-evolution simulation-based social change prediction analysis platform
To maintain high and sustainable accuracy of simulation
Incorporating "self-evolving process" during simulation


SELF-EVOLVING SIMULATION FRAMEWORK
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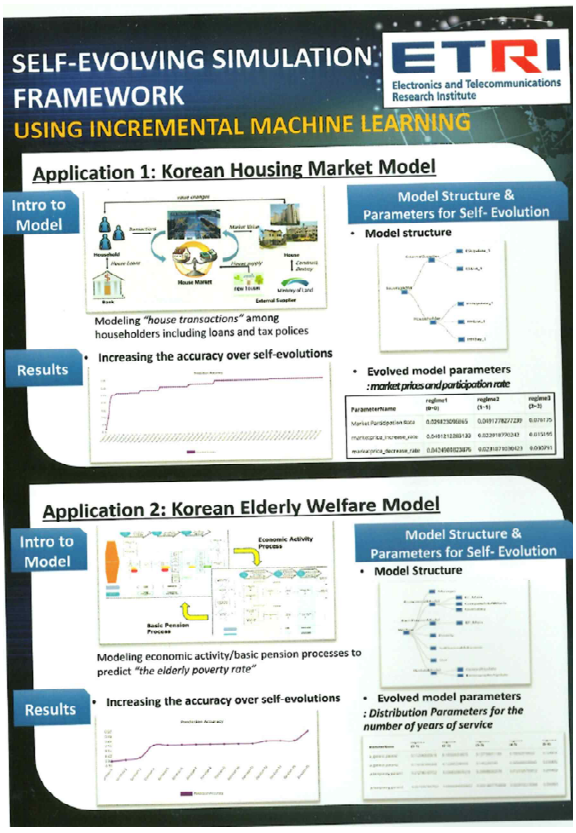
Self-Evolving Process
SES Framework
Simulated Model
Change Detection
Model Evolution
Evolution Strategy
Self-Evolving Process (Simulation x Machine Learning)
Change Detection compares simulation and real-data
Evolution Strategy changes model structure and parameters for closing the detected gap
Model Evolution realizes the discovered evolution strategy by the model reconfiguration
Recursively called until the gap is closed enough
Process of Self-Evolving Simulation Framework
1. Change Detection
2. Evolution Strategy
3. Model Evolution
Model Components Repository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USING INCREMENTAL MACHINE LEARNING
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Application 1: Korean Housing Market Model
Intro to Model
Model Structure & Parameters for Self- Evolution
Model structure
Modeling "house transactions" among householders including loans and tax polices
Results
Increasing the accuracy over self-evolutions
Evolved model parameters : market prices and participation rate
Application 2: Korean Elderly Welfare Model
Intro to Model
Model Structure & Parameters for Self- Evolution
Model Structure
Modeling economic activity/basic pension processes to predict "the elderly poverty rate"
Results
Increasing the accuracy over self-evolutions
Evolved model parameters : Distribution Parameters for the number of years of service

2) 부스 시연 현장


SELF-EVOLVING SIMULATION FRAMEWORK
USING INCREMENTAL MACHINE LEARNING
Predictive Analytics in Social Simulation
Motivation
Item
Descriptive Analytics
Predictive Analytics
Focus
Past
Future
Result
Causality Analysis
Optimal Decision
Objective
Detection/ Insight
Prediction/ Foresight
Self-Evolving Agent-Based Simulation Framework
Major Features
Incremental Modification of Simulation Models
Dynamic Structure to cope with Latent and Varying Factors
Change Detection from Models and Real Systems
Continuous Check for Model Validity
Data Assimilation by Simulation ABM Model Reconfiguration
Component Agent-Based Model
Dynamic Reconstruction of ABM Models
Machine Learning based Model Evolution
Algorithmic Automatic Enhancement of Fitness Value
Conceptual Vision of the Framework
Expected Effect of Self-evolving framework
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SELF-EVOLVING SIMULATION FRAMEWORK
USING INCREMENTAL MACHINE LEARNING
Self-Evolving Process of ABM Simulation Model
Self-Evolving Process (Simulation x Machine Learning)
- Change Detection compares simulation and real-data
- Evolution Strategy changes model structure and parameters for closing the detected gap
- Model Evolution realizes the discovered evolution strategy by the model reconfiguration
Recursively called until the gap is closed enough
Key Technologies to enforce Self-Evolving ABM
Component ABM
DEVS(Discrete Event Specification) Engine
- C++ based DEVS Engine
- Linux support
- Dynamic Component Loading Support
DEVS ABM Components
- Atomic/Coupled DEVS Model
- Behavior/Action of Agent
- Component and its parameters can be dynamically changed
Dynamic Component Reconfiguration of ABM
Machine Learning
Automatic Regime Detection
- Non-parametric Hidden Markov Model
- Macroscopic Data used
Clustering Agents
- Variational Autoencoding(VAE)+DPMM
- Microscopic Data used
Sampling Based Optimization
- Gaussian Optimization of ABM Model Configuration
Automatic Regime Detection
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SELF-EVOLVING SIMULATION FRAMEWORK
USING INCREMENTAL MACHINE LEARNING
Korean Housing Market Model: Concept and Features
Overview & Features
Korean Housing Market Model
Modeling "house transactions" among house holders including loans and tax policies
Applying real-data on Korean Housing Market
Marketing Features
Householders: list/buy houses by their preference
Realtor: provide listed houses info
External Suppliers: construct/destroy houses
Real-Data on Housing Market
Overview of Korean Housing Market Model
House List Process of Householders
House Buy Process of Householders
Korean Housing Market Model: Structure and Results
Structure & Measures
Component-based Model Structure
Hierarchical and modular components
Enabling model reconfiguration during the model evolution
Performance Measure
MAPE between House prices and transaction volumes and the associated real-data
Prediction Accuracy: 1 – average of MAPEs
Component-Based Model Structure
Iteration 0 (at initial)
Iteration 100 (after evolution)
Model Structure Changes
Model Parameter Changes
Fitting Changes by the Iterations of Self-Evolving Process
Increasing prediction accuracy as the iterations proceed
Accuracy Increases by Self-Evolving Process (up to 90%)
Calibrated Model Structure and Parameters by Self-Evolving Process: (Left) 1 to (Right) 100 Iterations
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SELF-EVOLVING SIMULATION FRAMEWORK
USING INCREMENTAL MACHINE LEARNING
Korean Elderly Welfare Model: Overview
Overview & Modeling
Korean Elderly Welfare Model
Modeling economic activity/basic pension processes to predict the elderly poverty rate in Korea
Applying real-data collected from Statistics Korea
Modeling
EconomicModel: Manage the elderly economic behaviors process
BasicPensionModel: Control the basic pension process
JobAgency: Employ/Lay off the elderly people
Person: Correspond to the elderly person
Behavioral Atomic Models
GiveSalary
ComputeJobAttitude
SetDisposableIncome
Goal
Analyzing the elderly behaviors according to the elderly policy change
Predicting the labor force participation rate, the basic pension rate, the poverty rate for the elderly in the future
Proposing new policy parameters to solve the income inequality
Korean Elderly Welfare Model : Results
Results
Experimental Environment
Accuracy Measure: MAPE
Data Set: Collected from Statistics Korea (Elderly Poverty Rate, Basic Pension Rate, Labor force participation Rate)
Parameters to Self-evolution: Distribution Parameters for the number of years of service
Experimental Results
We showed that our system improves the accuracy gradually by self-evolving process
Initial comparison
Iteration 16 (after evolution)
Model Structure Changes
Model Parameter Changes
Increasing prediction accuracy as the iterations proceed
The pattern is getting closer to the real data (validation data)
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Prediction Accuracy
KAIST
Clunix
SES : Self-Evolving Modeling & Simulation
Overview & Features
Structure & Measures


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SELF-EVOLVING SIMULATION FRAMEWORK
Predictive Analytics in Social Simulation
Self-Evolving Agent-Based Simulation Framework

3) 설명

WSC 는 시뮬레이션 학회 중에서도 큰 축에 속하는 학회로 학회 기간에 전시회 및 발표, 워크숍 등을 진행

ETRI는 전시회 및 발표에 참여하였으며, 우리 연구원은 복지 모델 시나리오 설명을 위해 함께 전시회 시연에 참석하였음

부스 브로셔 및 부스 시연 현장은 위 사진들을 참고

다양한 국가의 사람들이 우리나라에서 진행하고 있는 연구에 대해 관심을 가졌으며, 어떻게 적용되고 있는지 실제 사례에 대해 궁금해 하였음

특히, 고령화 및 노인빈곤 문제는 우리나라만의 문제가 아니라 국외 연구자들도 공감할 수 있는 사례임을 확인할 수 있었음
- 복지 모델 모형의 flow chart 설명
- 복지 모델 모형 method 설명
- 복지 모델 시나리오가 시뮬레이션 프레임 안에서 어떻게 작동하고 있는지에 대해 설명