UNIVERSITY OF TARTU
Institute of Computer Science
Computer Science Curriculum

Muhammad Uzair

Soft Computing Techniques For Forest Fires Prediction

Master's Thesis (30 ECTS)

Supervisor: Dr. Stefania Tomasiello

Tartu 2021

Soft Computing Techniques For Forest Fires Prediction

Abstract:
Forests provide fresh air and they are the source of livelihood to a huge number of people around the world. The forest fires affect the human lives in different ways such as economic, environment and health and these forest fires are usually caused by human negligence, and other environmental factors. The forest fire problem is divided into categories, i.e. fire risk, forest fire detection, and the prediction of burnt area. Developing a system to cater for solutions to this problem can help to use the resources in an efficient manner and can also save human lives and wildlife. In this thesis, some soft computing techniques are discussed, to predict the burnt area from forest fires. The considered soft computing techniques are ANFIS, ANN, SVM. In particular, a new variant of ANFIS is presented. Two publicly available datasets were used: one from Portugal and one from Canada. The techniques were applied separately on both datasets and results were collected.

Keywords:
Machine learning, Fuzzy inference systems, Fractional regularization

CERCS: P170 Computer science, numerical analysis, systems, control

Metsatulekahjude ennustamise pehmed arvutamistehnikad

Lühikokkuvõte:
Metsad pakuvad värsket õhku ja need on elatusallikaks paljudele inimestele kogu maailmas. Metsatulekahjud mõjutavad inimelusid mitmel viisil, näiteks majanduslikus, keskkonna- ja terviseküsimustes ning need metsatulekahjud on tavaliselt põhjustatud inimlikust hooletusest ja muudest keskkonnateguritest. Metsatulekahju probleem jaguneb sisekategooriateks, st tuleoht, metsatulekahjude avastamine ja põlenud ala prognoosimine. Selle probleemi lahendamiseks mõeldud süsteemi väljatöötamine võib aidata kasutada ressursse tõhusal viisil ning päästa ka inimelusid ja elusloodust. Selles lõputöös käsitletakse mõningaid pehmeid arvutustehnikaid, et ennustada põlenud ala metsatulekahjude põhjal. Käsitletavad pehmete arvutitehnikad on ANFIS, ANN, SVM. Eelkõige esitleti ANFISe uut varianti. Kasutati kahte avalikult kättesaadavat andmekogumit: ühte Portugalist ja Kanadast. Meetodeid rakendati eraldi nii andmekogumites kui ka kogutud tulemustes.

Võtmesõnad:
Masinõpe, Hägusad järeldamissüsteemid, Murdosa seadustamine

CERCS: P170 Computer science, numerical analysis, systems, control

I. Licence

Non-exclusive licence to reproduce thesis and make thesis public

I, **Muhammad Uzair**,

1. herewith grant the University of Tartu a free permit (non-exclusive licence) to

   reproduce, for the purpose of preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright,

   Soft Computing Techniques For Forest Fires Prediction,

   supervised by Dr. Stefania Tomasiello.

2. I grant the University of Tartu a permit to make the work specified in p. 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 3.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work, from 25/03/2024 until the expiry of the term of copyright.

3. I am aware of the fact that the author retains the rights specified in p. 1 and 2.

4. I certify that granting the non-exclusive licence does not infringe other persons' intellectual property rights or rights arising from the personal data protection legislation.

Muhammad Uzair
08/03/2021