Ecovision: ECOVISION: Deep Learning model for seasonal detection

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1. Introduction

Seasonal changes significantly influence plant growth, agricultural productivity, and environmental conditions.Accuratedetectionoftheseseasonalphasesisessentialforfarmers,ecologists,andclimate researchers.Traditionally,seasonalidentificationreliesonmanualobservationofplantfeaturesorlarge-scalemeteorologicaldata,whichisoftentime-consumingandimprecise.

With advancements in Artificial Intelligence and Machine Learning (AIML), it is now possible tocombine image-based plant phenology with environmental parameters to produce highly reliable seasonal detection systems.**Ecovision**isaninnovativedeeplearning-basedsolutionthatpredictstheseasonofaplantortree by analyzing its image along with environmental factors such as temperature, humidity, precipitation, soil moisture, wind speed, pressure, solar radiation, and cloud visibility. This multimodal approach offers a comprehensiveunderstandingofecologicalpatternsandsupportsdata-drivendecision-makingin agriculture and environmental monitoring.

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2. ProblemStatement

Current seasonal detection depends heavily on manual observation and conventional weather-based predictions, which often lack accuracy and consistency. Image-only prediction models fail toconsider important climatic influences, while weather-only models disregard visual phenological cues of plants.

Thus, there is a need for an automated, intelligent system that integrates**image features**and **environmental parameters** to accurately detect the current season. The challenge is to develop a model capableofhandlingdiverseplantspecies,variableweatherconditions,andregion-specificenvironmental features.

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3. Objectives

PrimaryObjective

- Developadeeplearningmodelthataccuratelypredictstheseasonofaplant/treeusingitsimage and environmental parameters.

SecondaryObjectives

- Buildauser-friendlyinterfaceenablinguserstouploadplantimagesandinputenvironmentaldata.
- IntegrateCNN-basedimageprocessingwithclimaticparameteranalysisinahybridmodel.
- Createareliabledatasetcombiningplantimagesandenvironmentalreadings.
- Enhancepredictionaccuracyusingmultimodaldatafusion.
- Provideresultswithconfidencescoresforbetterinterpretation.
- Supportapplicationsinagriculture,climatestudies,andenvironmentalmonitoring.

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4. ExistingSystemvsProposedSystem

ExistingSystem

- Manualobservationofplantimagesandseasonalcues.
- Relianceonmeteorologicaldata alone.
- Image-onlyclassificationmodelsignoringenvironmentalinfluence.
- Highchancesofhumanerror.
- Limitedaccuracyduetosingle-typeinput.

Limitations

- Notscalable.
- Notadaptabletodifferentecosystems.
- Inconsistentresultsacrossregions.

ProposedSystem(Ecovision)

- Deeplearning-basedmodelusingboth**image+environmentalparameters**.
- CNNextractsplantphenologicalfeatures(leafcolor,drying,flowering).
- Neuralnetworkprocessestemperature,humidity,wind,andotherparameters.
- Fusionofbothdatastreamsforimprovedseasonalprediction.
- Userauthentication,databasestorage,andinteractiveUI.
- Highadaptabilityacrossplantspeciesandclimates.

Advantages

- Automatedandaccurate.
- Multimodal:considersvisual+climaticdata.
- Scalableanddeployableforagriculture,research,andclimatemonitoring.
- Reduceshumaneffortanderror.

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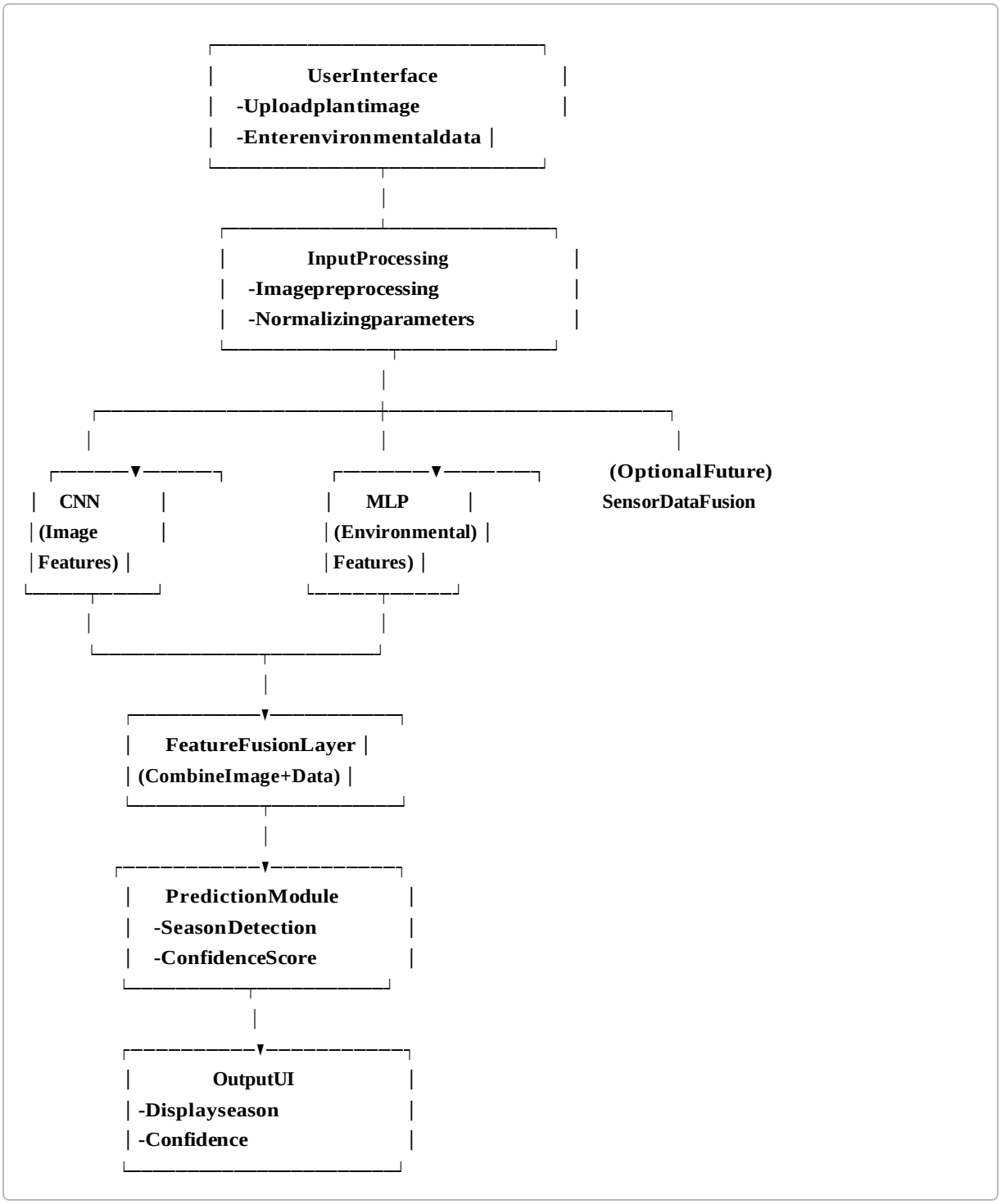
5. SystemArchitectureDiagram(TextRepresentation)



6. DatasetSuggestions

A. Plant/TreeImageDatasets

1. PlantPhenologyImageDataset(PPID)
2. AIEarthPlantPhenologyDataset
3. PlantVillageDataset(leavesandplantimages)
4. Kaggle-SeasonalPlantImagesDataset
5. OpenAerialorSeasonalTreeImageDataset

B. Environmental/WeatherDatasets

1. NOAAGlobalWeatherDataset
2. NASAEarthData
3. OpenWeatherMapHistoricalDataset
4. UCIrvineMLRepository–WeatherData
5. KaggleWeather&ClimateDatasets

C. BuildingaCombinedDataset

- Collectplant images per season.
- UseweatherAPIs(OpenWeather,NASAPOWER)tofetchenvironmentaldataforeachimage's location and date.
- LinkbothdatasetsusingCSVorSQLite.

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7. UIWorkflow

Step1:WelcomePage

- Title:*Ecovision*
- Button:**GetStarted**

Step2:SignIn/SignUp

- Newuserscreateanaccount.
- Existingusers login.
- CredentialsstoredinSQLite/SQLdatabase.

Step3:UploadImage

- Optiontouploadplant/treeimage.
- Basicpreviewoftheimage.

Step4:EnterEnvironmentalParameters

- Temperature
- Humidity

- Precipitation
- Pressure
- Windspeed
- Soilmoisture
- Cloudvisibility
- Solarradiation

Step5:PredictionProcess

- Backendsendsimage+valuestodeeplearningmodel.
- Modelprocessesboth streams.

Step6:OutputPage

- **PredictedSeason**(Summer/Winter/Monsoon/Spring/Autumn)
- **ConfidenceScore**
- Optionto re-uploadanother image.
- Downloadableresult(optional).

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8. Conclusion

Ecovisionpresentsanovelandintelligentapproachtoseasonaldetectionbycombiningplantphenology with environmental parameters using advanced deep learning techniques. The fusion of image-based featuresandclimatedatabridgesthelimitationsoftraditionalandsingle-inputmodels,resultinginhigher accuracy and adaptability. This system has strong real-world applications in agriculture, smart farming, biodiversity monitoring, and climate research. By automating seasonal prediction, Ecovision enhances decision-makingandcontributestosustainableenvironmentalpractices.