NDVI-LAI equation library API

Documentation for Editorial process

Contents

The equation library

Brief description

The library provides an overview of NDVI-LAI conversion methods available in literature since 2017. Methods were categorized by the sensor they were derived from, the crop they refer to, and the biome of the experimental field. Algorithms included in the library are fully documented at https://doi.org/10.6084/m9.figshare.20359437.v2

Available methods refer to field crops for now, but the library can be further extended to other land cover and be fed with other remote sensing products. The croplands under investigations so far were: wheat, maize, barley, rice, vineyard, soybean, eucalypt, sunflower, sugarcane, pasture, forests, poplar plantations and mixed land cover.

Input/output data

Table S1. Input variables for the equations

Variable Name	Unit	Description
NDVI	unitless	Normalized Difference Vegetation Index

Table S2. Output variables of the library

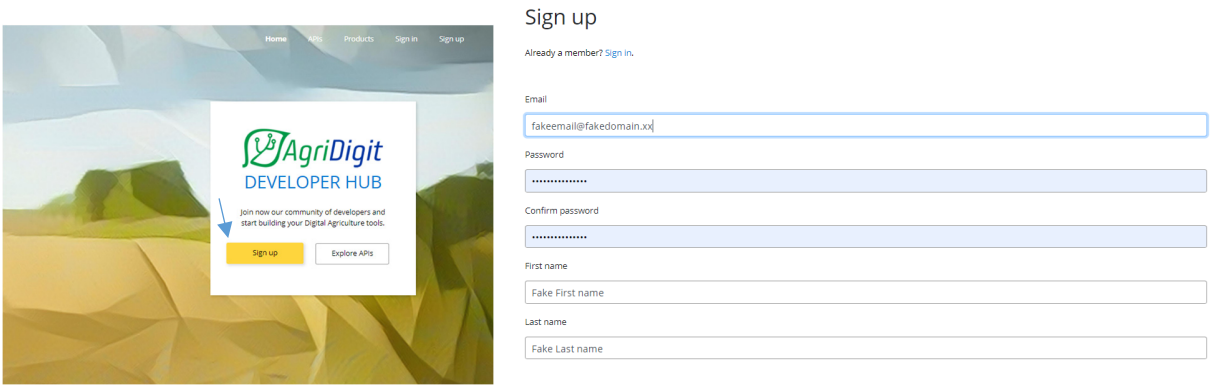
Variable Name	Unit	Description
LAI	unitless	Leaf area index

API Portal registration and Model Call

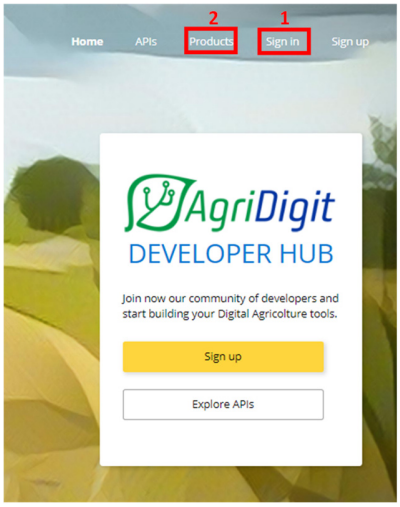
API Portal registration step-by-step

1. Register at the URL: https://developer.progettoagridigit.it

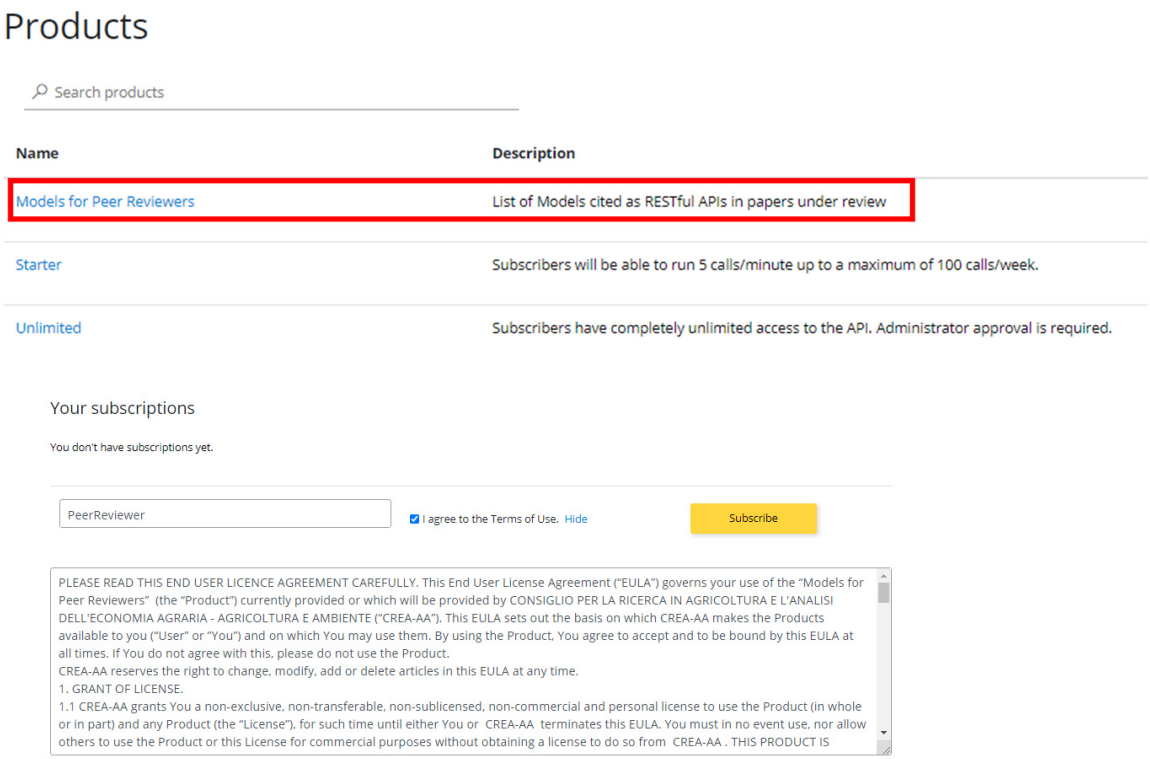
IMPORTANT: please use an anonymous email address: we do not want to know your identity as a Reviewer of our papers! In addition, please use fake First and Last name in the form as in the Figure below.



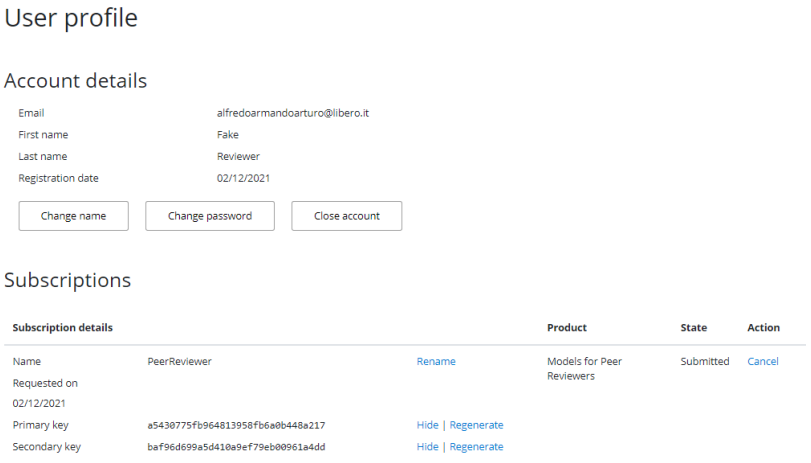
2. Once you have registered, you will receive an email at your anonymous email address. Click on the link in the email for validation, then, by using the email address you used at point 1, write an email to saas_admin@crea.gov.it, mentioning this code 854YBU58ZQ4JWCKYXC3HMSS (a unique key we have generated for this paper, to be kept confidential) and asking to be promoted to the "Peer Reviewer" user group.
3. You will receive an email from CREA where we confirm your subscription to the "Peer Reviewer" group.
4. Once you have received the email, Sign in at the url: https://developer.progettoagridigit.it and click on the button "Products".



5. You will see a new product named "Models for Peer Reviewers". Click on it, give a name to the subscription that's meaningful to you and click on subscribe. Important: by clicking on subscribe you accept the Terms of Use.



6. You will see a "subscription details" screen. Copy and keep safe the keys, as they will be used to invoke CREA's APIs. They can be regenerated at any time from your account.



7. You will receive an email confirming your subscription activation. You can now use the NDVI-LAI conversion library.

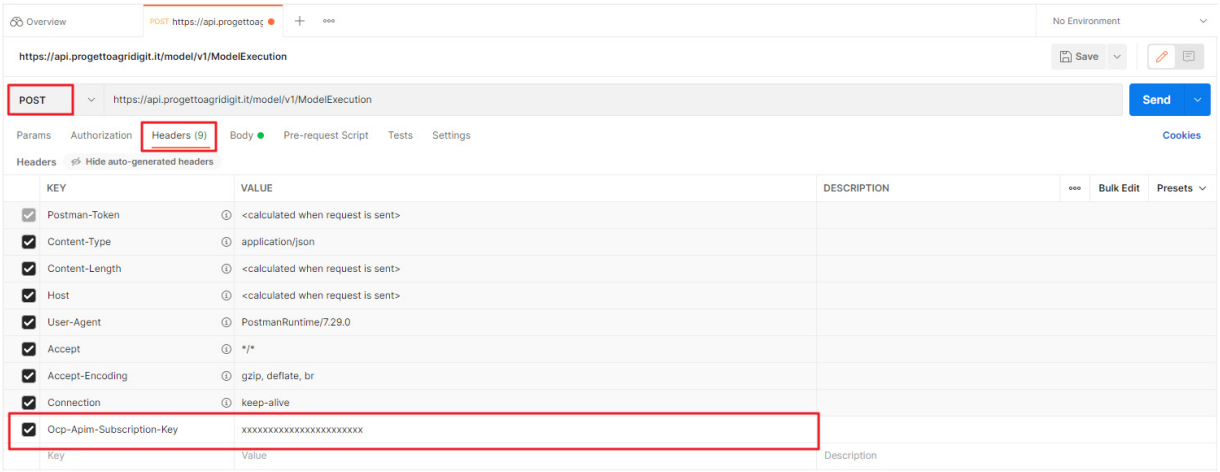
API Configuration and Call

Among the submission items you will find the file "MaizeANDTemperate.json" (and other five API configuration files that allow you to replicate data shown in Figure 5 of the paper), that is already filled with NDVI data and can be directly used to test the API.

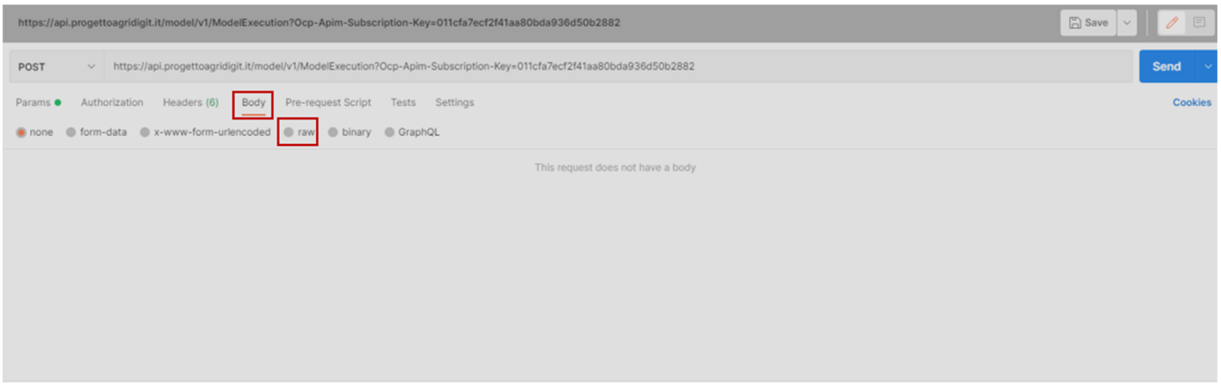
Prepare an HTTP POST request (with Postman - https://www.postman.com/ - or a similar tool), fill in the url:

https://api.progettoagridigit.it/model/v1/ModelExecution

Go to the “Headers” section, add as key Ocp-Apim-Subscription-Key and as value the primary key you activated when your subscription was approved.



Go to the “Body” section, and click on “raw”



Change the format from “Text” to “JSON”

In the body section copy the content of file “MaizeANDTemperate.json” (use other configurations for other use case scenarios)

Trigger the HTTP POST request (click on “SEND” button in Postman). Allow for some seconds for the answer.

To run the library with your own NDVI data, use a json template like the one shown in the attached file: "NDVILAI_template.json". Here, near the " SatelliteData" key inside the "SatelliteDataProvider" element, there is a placeholder. NDVI data must be copied to replace <placeholder_satellitedata> with the code reported in the file “SatelliteDataExample.json”.

In the latter file each record contains a single NDVI value accompanied by location and date of the observation. Records are delimited by curly brackets and separated from each other by commas.

Substitute the placeholder <placeholder_ satellitedata > with the list obtained in last step.

To be sure of what you did, we strongly recommend that you pass the Json created in the last step into a Json validator

The final json obtained in last step is ready to be used in the body of a the HTTP POST request to the URL:

https://api.progettoagridigit.it/model/v1/ModelExecution

Don't forget to put in your HTTP POST request the header with your product activation key that you received when your subscription was approved.

The header must have the label: Ocp-Apim-Subscription-Key and as value the key you have received.

API call enables users to query the software library for single functions or multiple function attributes (crop, sensor, biome, platform, spatial resolution). To configure a query, the user must replace/introduce the items of interest in the lists of the elements: “Crops”, “Sensors”, “Biomes”,

“Platforms”, “Resolutions”., “CropTypes” available in the sample API call json files as shown here below:

```
    },
    "Crops": [
    ],
    "Sensors": [
    ],
    "Biomes": [
      "Temperate_Broadleaf_Mixed_Forests",
      "Temperate_Grasslands_Savannas_Shrublands"
    ],
    "Platforms": [
    ],
    "Resolutions": [
      "High"
    ],
    "CropTypes": [
      "PerennialCrop",
      "SummerCrop",
      "WinterCrop"
    ],
```

Available items grouped by category are reported below:

- The filter StrategiesToRun can be invoked with values

  NDVItoLAI_Sanchez_et_al_2012,
  NDVItoLAI_Berni_et_al_2009,
  NDVItoLAI_Godwa_et_al_2016_a,
  NDVItoLAI_Godwa_et_al_2016_b,
  NDVItoLAI_Thiongo_et_al_2016
  NDVItoLAI_Timmermans_et_al_2013_b
  NDVItoLAI_Timmermans_et_al_2013_c
  NDVItoLAI_Wiatrak_et_al_2010_a
  NDVItoLAI_Wiatrak_et_al_2010_b
  NDVItoLAI_Afrasiabian_et_al_2020_a
  NDVItoLAI_Afrasiabian_et_al_2020_b
  NDVItoLAI_Afrasiabian_et_al_2020_c
  NDVItoLAI_Afrasiabian_et_al_2020_d
  NDVItoLAI_Lopez_Lozano_et_al_2010
  NDVItoLAI_Caruso_et_al_2017
  NDVItoLAI_Colombo_et_al_2003
  NDVItoLAI_Johnson_et_al_2001
  NDVItoLAI_Johnson_et_al_2003
  NDVItoLAI_Towers_et_al_2019_a
  NDVItoLAI_Towers_et_al_2019_b
  NDVItoLAI_Baez_Gonzalez_et_al_2005
  NDVItoLAI_Diker_Bausch_2003_a
  NDVItoLAI_Diker_Bausch_2003_b
  NDVItoLAI_Fei_et_al_2012
  NDVItoLAI_Guindin_Garcia_et_al_2012_a
  NDVItoLAI_Guindin_Garcia_et_al_2012_b
  NDVItoLAI_Guindin_Garcia_et_al_2012_c
  NDVItoLAI_Hong_et_al_2004
  NDVItoLAI_Huang_et_al_2018_a
  NDVItoLAI_Huang_et_al_2018_b
  NDVItoLAI_Jayasree_et_al_2013
  NDVItoLAI_Jinling_et_al_2009_b

NDVItoLAI_Jin_et_al_2016
NDVItoLAI_Kim_et_al_2012_a
NDVItoLAI_Kim_et_al_2012_b
NDVItoLAI_Kim_et_al_2012_c
NDVItoLAI_Kim_et_al_2012_d
NDVItoLAI_Kim_et_al_2012_e
NDVItoLAI_Kim_et_al_2012_f
NDVItoLAI_Kim_et_al_2012_g
NDVItoLAI_Kim_et_al_2012_h
NDVItoLAI_Kross_et_al_2015
NDVItoLAI_Li_et_al_2017
NDVItoLAI_Nguy_Robertson_et_al_2014_a
NDVItoLAI_Ramos_et_al_2018
NDVItoLAI_Soria_et_al_2012
NDVItoLAI_Thomason_et_al_2007
NDVItoLAI_Timmermans_et_al_2013_a
NDVItoLAI_Toureiro_et_al_2017
NDVItoLAI_Vincini_et_al_2007
NDVItoLAI_Wilson_Meyer_2007
NDVItoLAI_Vina_et_al_2011
NDVItoLAI_Xavier_Vettorazzi_2004_a
NDVItoLAI_Xavier_Vettorazzi_2004_b
NDVItoLAI_Xavier_Vettorazzi_2004_c
NDVItoLAI_Xavier_Vettorazzi_2004_d
NDVItoLAI_Xia_et_al_2016
NDVItoLAI_Xie_et_al_2018
NDVItoLAI_Yan_Li_et_al_2014_a
NDVItoLAI_Yan_Li_et_al_2014_b
NDVItoLAI_Yan_Li_et_al_2014_c
NDVItoLAI_Yan_Li_et_al_2014_d
NDVItoLAI_Yan_Li_et_al_2014_e
NDVItoLAI_Yonah_et_al_2018_a
NDVItoLAI_Yonah_et_al_2018_b
NDVItoLAI_Yueting_et_al_2008_b
NDVItoLAI_Cheng_et_al_2007_a
NDVItoLAI_Cheng_et_al_2007_b
NDVItoLAI_Guo_et_al_2012_a
NDVItoLAI_Guo_et_al_2012_b
NDVItoLAI_Kimura_et_al_2004
NDVItoLAI_Kulkarni_Honda_2020
NDVItoLAI_Lee_et_al_2017_a
NDVItoLAI_Lee_et_al_2017_b
NDVItoLAI_Lee_et_al_2017_c
NDVItoLAI_Liu_et_al_2017
NDVItoLAI_Maki_Homma_2014
NDVItoLAI_Raksapatcharawong_et_al_2020_a
NDVItoLAI_Raksapatcharawong_et_al_2020_b
NDVItoLAI_Ryu_et_al_2020
NDVItoLAI_Wang_et_al_2007
NDVItoLAI_Wu_et_al_2016
NDVItoLAI_Zhang_et_al_2019_a
NDVItoLAI_Trepos_et_al_2020
NDVItoLAI_Tunca_et_al_2018
NDVItoLAI_Bochenek_et_al_2017_a
NDVItoLAI_Bochenek_et_al_2017_b
NDVItoLAI_Chahbi_et_al_2014
NDVItoLAI_Chattaraj_et_al_2013
NDVItoLAI_Chaurasia_et_al_2011_a

NDVItoLAI_Chaurasia_et_al_2011_b
NDVItoLAI_Chaurasia_et_al_2011_c
NDVItoLAI_Chaurasia_et_al_2011_d
NDVItoLAI_Chaurasia_et_al_2011_e
NDVItoLAI_Chaurasia_et_al_2011_f
NDVItoLAI_Diarra_et_al_2017
NDVItoLAI_Dong_et_al_2013
NDVItoLAI_Dong_et_al_2015
NDVItoLAI_Duchemin_et_al_2006
NDVItoLAI_Fu_et_al_2020
NDVItoLAI_Hadria_et_al_2006
NDVItoLAI_Heinzel_et_al_2005
NDVItoLAI_Huang_et_al_2015_a
NDVItoLAI_Jiang_et_al_2018_a
NDVItoLAI_Jiang_et_al_2018_b
NDVItoLAI_Jiang_et_al_2018_c
NDVItoLAI_Jiang_et_al_2018_d
NDVItoLAI_Jinling_et_al_2009_a
NDVItoLAI_Ji_et_al_2021
NDVItoLAI_Kaur_et_al_2017
NDVItoLAI_Kokhan_Vostokov_2020_a
NDVItoLAI_Kokhan_Vostokov_2020_b
NDVItoLAI_Lelong_et_al_2008
NDVItoLAI_Liu_et_al_2018
NDVItoLAI_Martinez_et_al_2010
NDVItoLAI_Mokhtari_et_al_2018
NDVItoLAI_Lu_et_al_2005
NDVItoLAI_Nguy_Robertson_et_al_2014_b
NDVItoLAI_Padilla_et_al_2012
NDVItoLAI_Rodriguez_et_al_2004
NDVItoLAI_Roumenina_et_al_2013_a
NDVItoLAI_Roumenina_et_al_2013_b
NDVItoLAI_Schonert_et_al_2015
NDVItoLAI_Sultana_et_al_2014_a
NDVItoLAI_Sultana_et_al_2014_b
NDVItoLAI_Sun_et_al_2018
NDVItoLAI_Tang_et_al_2005
NDVItoLAI_Tan_et_al_2020_a
NDVItoLAI_Tan_et_al_2020_b
NDVItoLAI_Tan_et_al_2020_c
NDVItoLAI_Tan_et_al_2020_d
NDVItoLAI_Tan_et_al_2020_e
NDVItoLAI_Tan_et_al_2020_f
NDVItoLAI_Tripathi_et_al_2013
NDVItoLAI_Verger_et_al_2011
NDVItoLAI_Wu_2014_a
NDVItoLAI_Wu_2014_b
NDVItoLAI_Wu_2014_c
NDVItoLAI_Wu_2014_d
NDVItoLAI_Wu_2014_e
NDVItoLAI_Wu_et_al_2010_b
NDVItoLAI_Wu_et_al_2010_a
NDVItoLAI_Xie_et_al_2015
NDVItoLAI_Yueting_et_al_2008_a
NDVItoLAI_Zhang_et_al_2006
NDVItoLAI_Zhang_et_al_2019_b
NDVItoLAI_Zhao_et_al_2012

- The filter Crops can be invoked with values
  Barley
  Eucalypt
  Forest
  Maize
  MixedLandCover
  Pasture
  Poplar
  Rice
  Soybean
  Sugarcane
  Sunflower
  Vineyard
  Wheat

- The filter Sensors can be invoked with values
  AdvancedWideFieldSensor
  AISA
  ASD
  AVHRR
  BJ1
  FieldHyperspectral
  GeoEye1
  GF1
  GreenSeeker
  HJ
  Hyperion
  IKONOS
  Landsat
  MODIS
  MultispectralCamera
  Pleiades1A
  PortableSpectroradiometer
  PROBAV
  PushbroomHyperspectralImager
  Quickbird
  RapidEye
  RapidScan
  Sentinel2
  SPOT
  SPOTVGT
  UAV
  WorldView2
  WorldView3

- The filter Biomes can be invoked with values
  Deserts_Xeric_Shrublands
  Mediterranean_Forests_Woodlands_Scrub
  Montane_Grasslands_Shrublands
  Temperate_Broadleaf_Mixed_Forests
  Temperate_Grasslands_Savannas_Shrublands
  Tropical_Subtropical_Dry_Broadleaf_Forests
  Tropical_Subtropical_Grasslands_Savannas_Shrublands
  Tropical_Subtropical_Moist_Broadleaf_Forests

- The filter Platforms can be invoked with values

Airborne
Field
Satellite

- The filter CropTypes can be invoked with values
  WinterCrop
  PermanentCrop
  Forest
  SummerCrop
  MixedLandCover
  PerennialCrop

- The filter Resolutions can be invoked with values
  Low
  Moderate
  High
  VeryHigh

The user can retrieve all the categories available in the filters by setting the DocumentationCall element to true in any of the API sample calls provided and sending the request.