TILLAGE IDENTIFICATION^{BETA}

API Documentation
2020

Service Overview

The Ag-Analytics® Tillage Model API uses artificial intelligence algorithms to determine whether a field has been tilled at a certain date of the year. The Tillage Model API provides service by considering satellite imagery, field location, and time of the year.

The Tillage Model is a "backfilling model", meaning that it can determine whether a field was tilled in the past, rather than provide prediction as to whether a field will be tilled. The model uses a seven-week window of satellite imagery, so as long as the date requested is more than three weeks prior to the current date (i.e., if today is Monday of the 20th week of the year, the latest request that can be made is for the 16th week.).

This document includes information about a POST request, which returns a tillage prediction for the date passed, and a GET request for returning a file of the tillage raster that was generated during the POST request. The returned file is geospatially oriented according to the coordinate system specified in the POST request return and can be displayed in a GIS application.

Model Specifications

The Tillage Model predicts tillage using one of two models that have been trained on approximately 2,000 tillage records from real farming operations. The dataset of tillage operations is used for ground truthing to create a verification label. Without the ground-truth data, there would be no way to tell the model that it predicted tillage correctly, and no way to determine the accuracy of a trained model.

The models are trained on three categories of data. The first is the location of the field geospatially. Tillage practices may vary in different areas of the country, so the addition of geospatial coordinates can illuminate some of these relationships. The second is the week of the year. In combination with the location of the field, the week of the year can help determine whether a field is able to be tilled at a given time of year. For example, tilling in Florida happens at a different time than in Minnesota. Third, remote sensing satellite imagery is used to find

patterns in the ground reflectance that happen before, during, and after tillage. The temporal reflectance patterns are the primary driver for the tillage model in determining whether the field has been tilled. Currently, the model uses a seven-week window of satellite imagery.

POST Request

API: 🔗   Here

Header Parameters
Execute Type: POST
content-type: "application/json"

API Specifications

Request Parameters

Parameter	Data Type	Required?	Default	Options	Description
SHAPE	Geometry, file/text	Yes	-	Geojson	Desired area-of-interest. See Fig. 1 for example.
ModelType	Text String	No	Neural Network	"NN" (Neural Network), "TREE" (Decision Tree)	Type of model to use for prediction. Default is neural network. Not necessary to specify for most cases.
TillageStartDate	Text	Yes	-	Date string "mm/dd/yyyy"	The date that tillage began. Must be in years {2014, 2015, 2016, 2017, 2018}. For 2019, must be more than 3 weeks prior to the current date. Ex. "04/23/2017"

ScalarVariables	Dictionary	Yes	-	-	Wrapper dictionary for any variables that need to be included along with ModelType and SHAPE. Does not have a value itself. Please see sample request for clarification.

Response Parameters

Parameter	Data Type	Description
feature_averages	Dictionary	Average value of each input used to predict tillage.
raster_filename	String	URL to use in GET request to retrieve predicted raster file.
rasterinfo	List of Dictionaries	Container for the features and metadata information for the raster.
attributes	Dictionary	Container for specific features regarding the tillage prediction raster.
CellSize	List	Size of a single cell in the raster in degrees. (0.0001, -0.0001) roughly corresponds to an 8 meter by 8 meter square on the Earth's equator. (i.e., 0.0001 degrees ~= 8 meters)
CoordinateSystem	String	Information about the coordinate system being used for calculations.
Extent	String	Specifies the left bottom corner and right top corner in longitude and latitude respectively.

Legend	List of Dictionaries	List of the metadata features for the areas of the field that returned as till or no-till or both.
Area	String	Specifies a percentage of the field that returned either till or no-till. For example, if 50% of the field is "till", then Area is 50%.
Area(ac)	Float	Specifies the number of acres that were till or no-till for a given field.
Count	Integer	Number of pixels that returned as till or no-till. Used to calculate area.
CountAllPixels	Integer	Total number of pixels that make up the field in the predicted tillage raster.
Till	String	Specifies whether the given section (or entire area) of the field has been tilled. Returns "Yes" for tillage and "No" for tillage not detected.
Value	Integer	Binary value for tillage detected or not. Tillage detected = 1, Tillage not detected = 0.
color	String	Color that can be used to display the feature when plotting in a GIS application. (Hexadecimal)
pngb64	String	PNG image of the tillage raster encoded as base64. Actual raster file can be obtained with a GET request to the service.

GET Request

API: 🔗   Here

Header Parameters
Execute Type: GET
content-type: "application/json"

API Specifications

Request Parameters

Parameter	Data Type	Required	Default	Options	Description
Filename	Text	Yes	-	.tif file	Filename that is returned by the initial POST request. Ex: "result_tillageraster_20191126_175158_3291.tif"

Response Parameters

Parameter	Data Type	Description
File	.tif	Tiff file will be download to the computer of the caller with the name that was used to call the API.

Appendix

Figure 1.

Shape Example - GeoJSON

```
"{\"type\":\"Feature\",\"geometry\":{\"type\":\"Polygon\",\"coordinates\":[
[[-89.199484,40.972729],[-89.199773,40.97258],[-89.200135,40.972415],[-
89.20034,40.972318],[-
89.200445,40.972177],[89.200439,40.972001]]]},\"properties\":{\"OBJECTID\":
5134895,\"CALCACRES\":122.651351,\"CALCACRES2\":null},\"id\":4861522}"
```

Figure 2

POST Request Example – application/json

```
application/json
{
"ModelType": "NN",
"SHAPE":
"{\"type\":\"Feature\",\"geometry\":{\"type\":\"Polygon\",\"coordinates\":[[[-
89.199484,40.972729],[-89.199773,40.97258],[-89.200135,40.972415],[-
89.20034,40.972318],[-89.200445,40.972177],[-89.200439,40.972001],[-
89.200404,40.971815],[-89.200245,40.971599],[-89.20004,40.971397],[-
89.199869,40.971233],[-89.199865,40.971097],[-89.199952,40.970952],[-
89.200264,40.97078],[-89.200517,40.970664],[-89.200903,40.970471],[-
89.201168,40.970345],[-89.201324,40.970277],[-89.201407,40.970174],[-
89.201428,40.970042],[-89.20271,40.970005],[-89.202738,40.970421],[-
89.202844,40.970431],[-89.202851,40.970648],[-89.203123,40.970666],[-
89.203216,40.973626],[-89.20332,40.973635],[-89.203281,40.972154],[-
89.203277,40.972049],[-89.203227,40.970607],[-89.204645,40.97055],[-
89.204639,40.970427],[-89.205456,40.970446],[-89.205638,40.970467],[-
89.206002,40.970527],[-89.206306,40.97059],[-89.206516,40.970642],[-
89.206711,40.97061],[-89.20688,40.970542],[-89.207086,40.970492],[-
89.207267,40.970414],[-89.207449,40.970364],[-89.207667,40.970286],[-
89.207849,40.970255],[-89.208057,40.970251],[-89.208287,40.970328],[-
89.208494,40.970369],[-89.208672,40.970421],[-89.208866,40.970506],[-
89.208972,40.970511],[-89.209009,40.970595],[-89.20893,40.970671],[-
89.208736,40.970787],[-89.208535,40.970909],[-89.208325,40.971052],[-
89.207907,40.971306],[-89.207633,40.971478],[-89.207313,40.971574],[-
89.207065,40.971645],[-89.206566,40.971699],[-89.206246,40.971784],[-
89.205998,40.971878],[-89.205548,40.972042],[-89.205013,40.97232],[-
```

```
89.20468,40.972494],[-89.204246,40.972725],[-89.203988,40.972931],[-
89.203819,40.973168],[-89.203666,40.973428],[-89.203616,40.973685],[-
89.203552,40.973966],[-89.203548,40.9743],[-89.203411,40.974615],[-
89.203284,40.974906],[-89.202723,40.975587],[-89.20283,40.975719],[-
89.203383,40.975106],[-89.203522,40.974847],[-89.203658,40.974521],[-
89.203723,40.974241],[-89.20381,40.97376],[-89.203891,40.973546],[-
89.20407,40.973197],[-89.204197,40.973016],[-89.204369,40.972868],[-
89.204686,40.972672],[-89.205018,40.972499],[-89.205351,40.972314],[-
89.205742,40.972139],[-89.206047,40.971999],[-89.206367,40.971904],[-
89.206907,40.971771],[-89.207303,40.971719],[-89.207551,40.971658],[-
89.207846,40.971535],[-89.207938,40.971481],[-89.208059,40.971448],[-
89.208267,40.971295],[-89.208534,40.971115],[-89.209089,40.970762],[-
89.209108,40.971493],[-89.209143,40.972829],[-89.209176,40.974108],[-
89.209236,40.977186],[-89.20442,40.977285],[-89.199613,40.977383],[-
89.199533,40.974593],[-
89.199484,40.972729]]]},\"properties\":{\"OBJECTID\":5102679,\"CALCACRES\":145.08
999634,\"CALCACRES2\":null},\"id\":5102679}",
"ScalarVariables": {
"TillageStartDate": "04-23-2018"
}
}
```

Figure 3

POST Response – application/json

```
{
  "feature_averages": [
    {
      "Key": "x",
      "Value": -89.2045206106589
    },
    {
      "Key": "y",
      "Value": 40.97395490907695
    },
    {
      "Key": "weekOfYear",
      "Value": 17.0
    },
    {
      "Key": "NDVIlag0",
      "Value": 0.2854981678564071
    },
    {
      "Key": "NDVIlag1",
      "Value": 0.2827049745202165
    },
    {
      "Key": "NDVIlag2",
```

```
      "Value": 0.2413254219881774
    },
    {
      "Key": "NDVIlag3",
      "Value": 0.18390155118856283
    },
    {
      "Key": "NDVIplus1",
      "Value": 0.24136899364844827
    },
    {
      "Key": "NDVIplus2",
      "Value": 0.3131521662145134
    },
    {
      "Key": "NDVIplus3",
      "Value": 0.43234145408330843
    },
    {
      "Key": "NDTIlag0",
      "Value": 0.13882370249834733
    },
    {
      "Key": "NDTIlag1",
      "Value": 0.9419920237052818
    },
    {
      "Key": "NDTIlag2",
      "Value": 0.18289781969953484
    },
    {
      "Key": "NDTIlag3",
      "Value": 0.9468203281547247
    },
    {
      "Key": "NDTIplus1",
      "Value": 0.14650789443128917
    },
    {
      "Key": "NDTIplus2",
      "Value": 0.2705449224700051
    },
    {
      "Key": "NDTIplus3",
      "Value": 0.9590315644866529
    }
  ],
  "raster_filename": "result_tillageraster_20191127_163228_9503.tif",
  "rasterinfo": [
    {
```

```
      "attributes": {
        "CellSize": [
          0.0001,
          -0.0001
        ],
        "CoordinateSystem": "GEOGCS[\"WGS 84\",DATUM[\"WGS_1984\",SPHEROID[\"WGS
84\",6378137,298.257223563,AUTHORITY[\"EPSG\",\"7030\"]],AUTHORITY[\"EPSG\",\"6326\"]],PRIMEM[\"Greenwic
h\",0],UNIT[\"degree\",0.0174532925199433],AUTHORITY[\"EPSG\",\"4326\"]]",
        "Extent": "-89.209236, 40.969983000000006, -89.19953600000001, 40.977383",
        "Legend": [
          {
            "Area": 283.7703164915481,
            "AreaPercent": "90.83 %",
            "AreaUnit": "ac",
            "Count": 5914,
            "CountAllPixels": 6511,
            "Till": "No",
            "Value": 0,
            "color": "#261f17"
          },
          {
            "Area": 28.645735364466386,
            "AreaPercent": "9.17 %",
            "AreaUnit": "ac",
            "Count": 597,
            "CountAllPixels": 6511,
            "Till": "Yes",
            "Value": 1,
            "color": "#516368"
          }
        ],
```

```
        "pngb64": "data:image/png;base64,
iVBORw0KGgoAAAANSUhEUgAAAGEAAABKCAYAAACrbTpWAAADBUlEQVR4nO2cu3HDMAxAIZ9X0KVMl0ZreAHNkCYjufEMWsBruFGnUpcl
UtGn8PgTCZIAyNfEF9syiUcQFGVrAMZ8fX78Yh5vus3vx/X6x6/ngnloK+u2j1fsjnTOc63dAEqYRv8xO1yvS+GCejQPpg5Rxtbe6Taj9gUl
E6bb/G90uBqov7aDkAkq4PpfCmCPWNPxMRBdE3JnHNbx0WqCalArUw1mP5MlmBpTS4Safo5TI6Xp0Ua26UgXoYKRQ5Ap0Mf/+UTUzt5i
S9TXc6neWRu1swVFAtXgplKqX4OUbYuU0VxzEK3bPopeooaQIiBEvO346r3r4y7nPOH1XEgW4BBRKGfMtQubagdX0FZHnINQmyQJeuA5
iaDUVrE1IeTawLrtY8rq0PWZZyRHS6A0khRnCu/yuI/z949XgO+YtudDFgqKohd1KBEiAKDM+UeUBN9FG2lgbAiqbRuTmCw1IedmnQT0
uGSdjqhlxfK4jHvO14ryTGwoiRwHOGxK6Hc2xoAmTbwqF/MP7YPY6vDdQzf+9dtH8XsoroIzYJq38Ar8klMqJW9TZwnUM928RLWbY9a
EZVEvATqWQDQgAQOdAkEEC2BQz0AECyBiwAAwRI40SUQoEsggEgJqh5wOEcAECqBS/AVIiWkfouiNCIlcEOcBG5ZACBMAkcBAMIkcBQA
IEQCpy0KE+wlcJ2CjrCVwO2EzAU7CZKCr/oyAPDokIRpR6HXMDYSJGBbQPTvHRXAt3ojVxO4Lzd1QvpDRoKkgnsWMhJaDL6iuARp042P
kMGVXYIe9BZHvK/PaBJsI7zFoJtwxQFNQg+2H1uMyBTmVjCJOCWhtaJaimAJkvZuqBEsoQvIh1NCn37KYJQgeQuB4sDqW9mFMQ2Ci+vJ
Dh7rto+2GA/qQc+GPIQM7mwXdY6/jtdv7FFKuC8AZ9thu32C6UfoZ2aWtwTMYjzdZucdVUL3mVz3jIi9Y0tuYqb1wfZEjAyudSW0r65M
SOm7dToybUGbGkF1RJYYCo//WTGiJM1nvqnUdxvwByVpyzW8CbPsAAAAASUVORK5CYII="
```

```
      }
    }
  ]
}
```

Figure 4.

GET Request Example - URL

```
https://ag-analytics.azure-
api.net/Tillage_Model?filename=result_tillageraster_20191126_175158_3291.tif
```

Citation

Spatial Reference Information:

Universal Transverse Mercator (UTM) Dominant Zone, North American Datum 1983

Please contact **support@analytics.ag**, **josh@ag-analytics.org**, or **woodardjoshua@gmail.com** with any comments or questions.