TILLAGE IDENTIFICATION**BETA**

*API Documentation*

*2019*

# 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](https://ag-analytics.portal.azure-api.net/docs/services/tillage-model/operations/tillage-identification)

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](https://ag-analytics.portal.azure-api.net/docs/services/tillage-model/operations/tillage-identification)

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

### **Figure 2** – POST Request Example

### **Figure 3** – POST Response Example

**Figure 4** – GET request example

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\":145.08999634,\"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[\"Greenwich\",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, "  }  }  ]  } |

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

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