credit karma™

Prediction Management: Enhancements

March 2019

What is the Prediction Management?

UI tool that allows Data Science to manage predictions and models

- Basic **add**/**delete**/**group** functions for predictions
- Basic **add**/**validate** functions for models
- **Export** predictions

What is the Model (Standard) Lifecycle?

10,000 ft view

3. Model Type Definition

4. Model Training

5. Deployment to Prod

6. Batch Model Scoring

Model Building

Model Scoring

2. Data Preparation

1. Feature Engineering

8. Model Deprecation

7. Model Metric Comparison
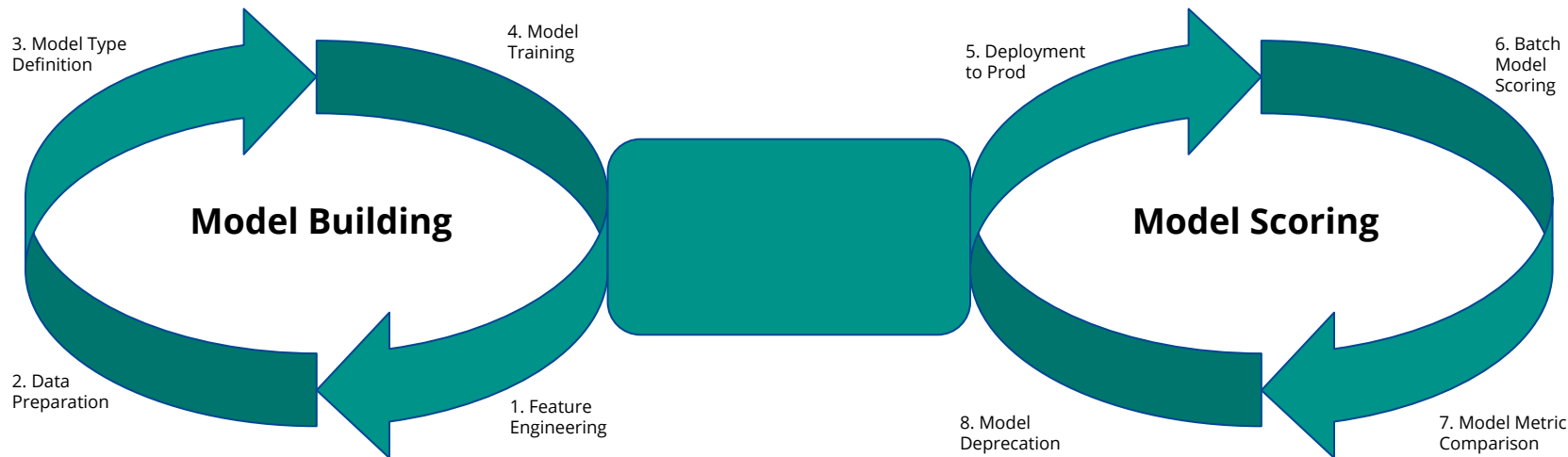
Direct Stakeholders:		- MLI team	- Data Scientists		- Skywalkers
Indirect Stakeholders:	Every Offer-Serving Vertical				

Roadmap of Prediction Management

What is the overall goal of the PM?

1,000 ft view
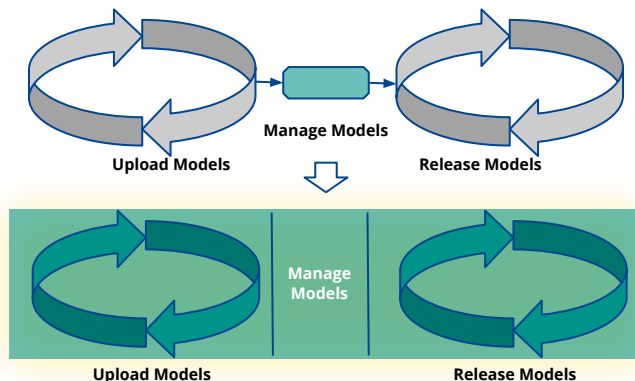
Provide a clear Interface for <u>full</u> management of CK Data Models

Upload Models within the PM to make it available for cross-team management and visualization

Potential full integration with model building process (?) - Feature Engineering, Dataset Prep, Model Training

Manage Models that have already been built
- Dynamic editing of models through 'Git' style sharing/merging
- Ability to observe model metrics, stats and productivity

Release Models into production for scoring and use live by (RecSys)

Automated interfacing with external tools (Prophecy for deployments, Darwin for testing/ramping)

Competitive Teardown

Companies to look at:

- Amazon Web Services
- Google Inc.
- SAS Institute Inc.
- FICO
- Hewlett Packard Enterprise

- Yottamine Analytics
- BigML, Inc.
- Microsoft Corporation
- Predictron Labs Ltd.
- IBM Corporation

Competitive Teardown

- Amazon Web Services
- SAS Institute
- IBM

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Competitor E.g. - Amazon Web Services (AWS)

Amazon SageMaker - Enables developers and data scientists to quickly and easily build, train, and deploy machine learning models at any scale. It removes the complexity that gets in the way of successfully implementing machine learning across use cases and industries

Interesting Features

One-click training and automatic model tuning with AutoML capabilities for the most accurate model predictions.

One-click deployment: Deploy with auto-scaling clusters spread across multiple zones to deliver both high performance and high availability.

Specific component of SageMaker called Amazon Personalization (similar use case to CK)

https://aws.amazon.com/machine-learning/
https://aws.amazon.com/personalize/
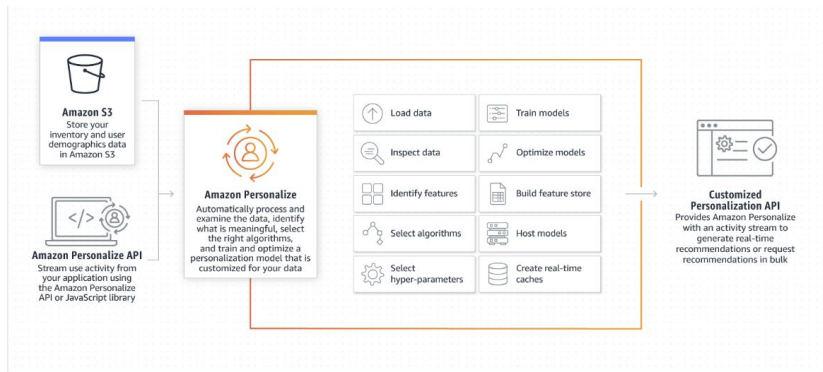
Competitor E.g. - SAS Institute

SAS Visual Data Mining and Machine Learning - Supports the end-to-end data mining and machine-learning process with a comprehensive visual – and programming – interface that handles all tasks in the analytical life cycle.

Interesting Features

Lets multiple users concurrently analyze any amount of structured and unstructured data with an easy-to-use visual interface.

Drag-and-drop interface lets data engineers quickly build and run transformations, augment data and join data within the integrated visual pipeline of activities. All actions are performed in memory to maintain data structure consistency.
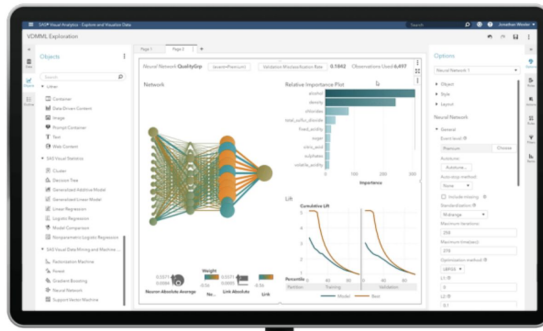
https://www.sas.com/content/sascom/en_us/23289/2323/visual-data-mining-machine-learning.html
https://www.sas.com/content/dam/SAS/en_us/doc/factsheet/sas-visual-data-mining-machine-learning-1082751.pdf

Competitor E.g. - IBM

IBM Watson - Machine Learning Interface for the entire model lifecycle
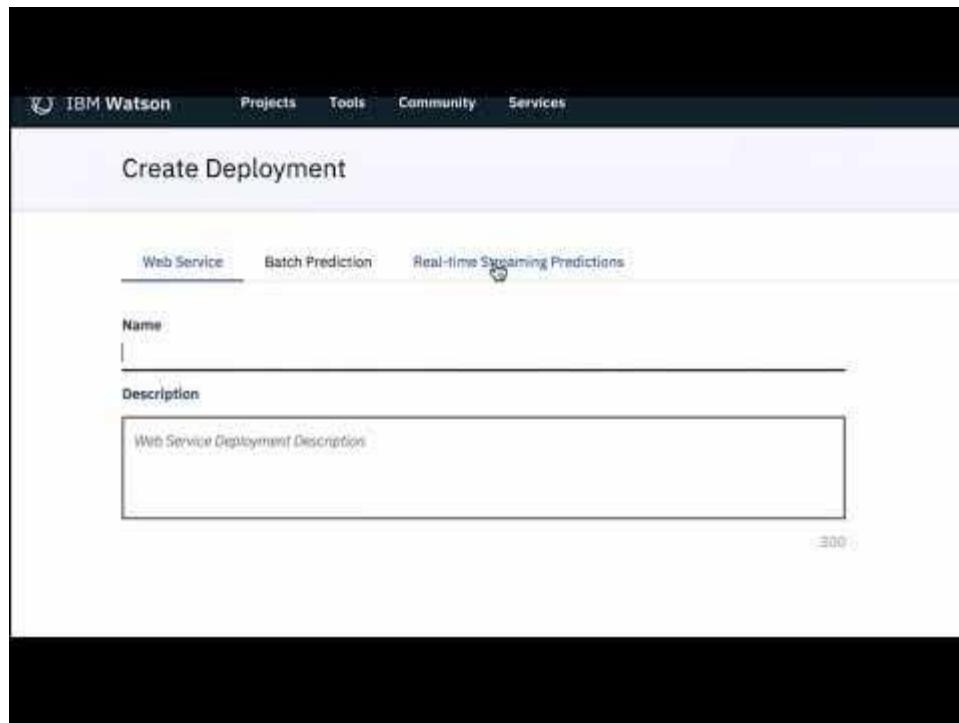
Interesting Features

For each model, you have detailed homepage with summary and all sorts of model info

Integrated model training within the interface.

Batch and streaming service to ingest data real time

https://www.ibm.com/cloud/machine-learning

Competitive Teardown - Model Lifecycle Management Comparison

How well are each of these features integrated in the overall product

	CK (Prediction Management)	Amazon Web Services (AWS)	SAS Institute	IBM	
Feature Engineering	🔴	🟢	🟢	🟡	**Model Upload**
Model Training	🔴	🟢	🟢	🟢	
Model Management	🟢	🟢	🟢	🟢	**Model Management**
Model Deployment	🟡	🟢	🟡	🟢	
Model Scoring	🔴	🟡	🟢	🟢	**Model Release**
Model Refresh	🟡	🔴	🟡	🟡	
Ease-of-use	🟡	🟡	🟢	🟢	
Visibility	🟡	🔴	🟢	🟢	

Integration of these features in overall product — Feature Engineering through Model Refresh

QOL — Ease-of-use, Visibility

Competitive Teardown - Model Lifecycle Management Comparison

How well are each of these features integrated in the overall product

	CK (Prediction Management)	Amazon Web Services (AWS)	SAS Institute	IBM
Feature Engineering	🔴	🟢	🟢	🟡
Model Training	🔴	🟢	🟢	🟢
Model Management	🟢	🟢	🟢	🟢
Model Deployment	🟡	🟢	🟡	🟢
Model Scoring	🔴	🟡	🟢	🟢
Model Refresh	🟡	🔴	🟡	🟡
Ease-of-use	🟡	🟡	🟢	🟢
Visibility	🟡	🔴	🟢	🟢

In the Red
Areas we want to focus improvement on

Competitive Teardown - Model Lifecycle Management Comparison

How well are each of these features integrated in the overall product

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Feature Engineering	🔴	🟢	🟢	🟡	**Model Upload**
Model Training	🔴	🟢	🟢	🟢	
Model Management	🟢	🟢	🟢	🟢	**Model Management**
Model Deployment	🟡	🟢	🟡	🟢	**Model Release**
Model Scoring	🔴	🟡	🟢	🟢	
Model Refresh	🟡	🔴	🟡	🟡	
Ease-of-use	🟡	🟡	🟢	🟢	
Visibility	🟡	🔴	🟢	🟢	
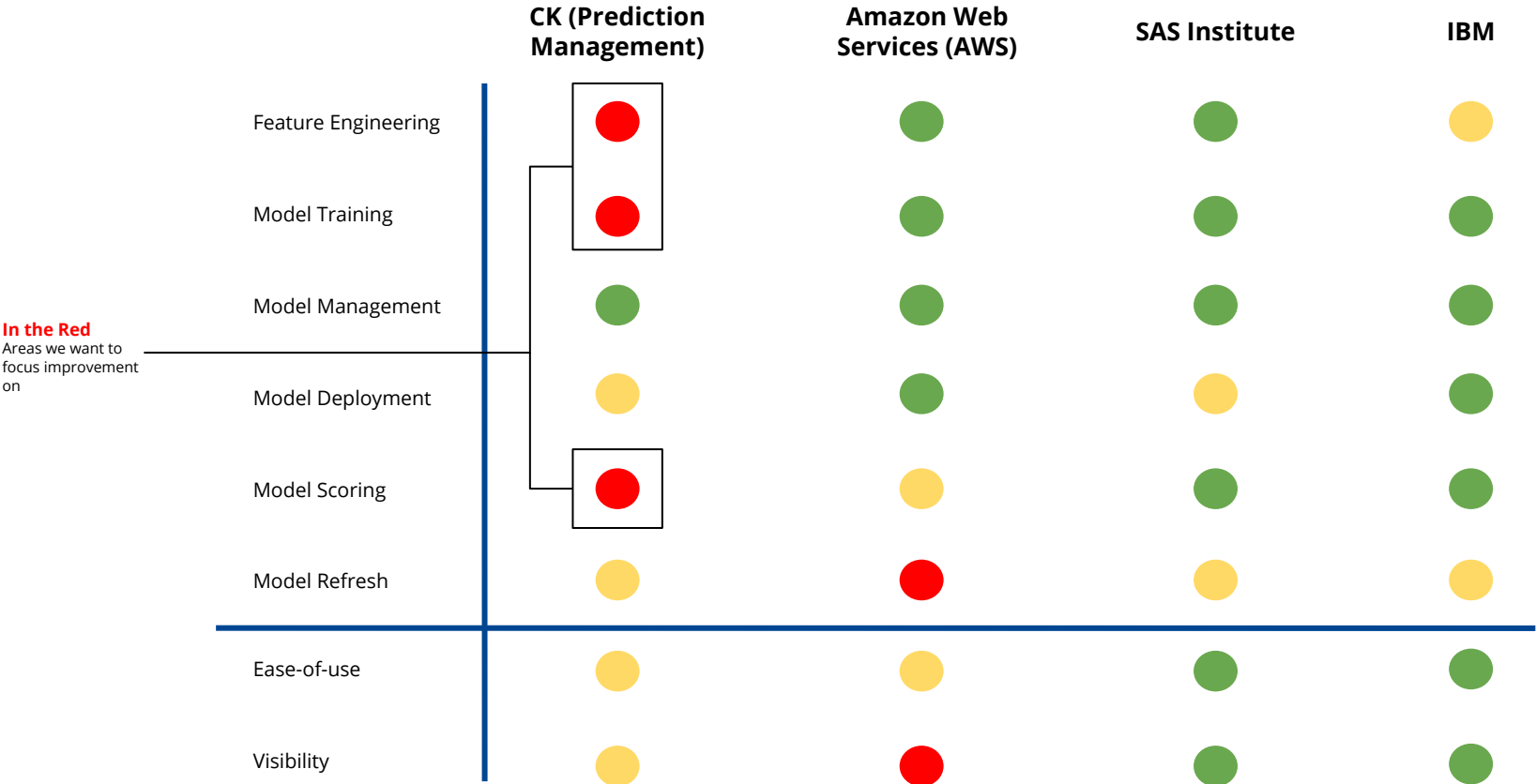
1st Improvement Area
Red areas where competitors have succeeded.
Model building components

2nd Improvement Area
Areas that need work
Model scoring components

3rd Improvement Area
Quality of life improvements

Roadmap of PM

1,000 ft view

"Meat & Bones" Framework (97% Complete)	"Armor" Framework		"Magic" Framework
Q1-Q2 2019	(?) H2 2019	(?) 2020	(?) Continuous

1 Model Management

- User Interface setup
- Git-style operation method allowing staged edits
- Enhancements to *Model Management*

2 Model Upload

- Integrate functionalities of *Feature Engineering*
- Host *Model Training*

3 Model Release

- Automate *Model Deployment*
- Provide tracking of *Model Scoring*
- *Model Refresh* capabilities

4 Quality of Life

- Optimize *Ease-of-Use* & Enhance *Visibility*

How do we build these?

Roadmap Double-Clicks and Mocks

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1st Improvement Areas - Model Upload
100 ft view

Feature Engineering | RP-3401

- Currently a Vega process
- Need to integrate into PM 2 pieces of Feature Engineering
  - Validation
  - Stats Tracking
- Visibility on Features for each Model
- Connection to BQ for constant analysis of potential Features?

Model Training | RP-3402

- With the availability of of features in the PM, model training looks at chosen datasets
- Can be based on PMML file parsing
- Dynamic to select specific features to train on

Upload Models   Manage Models   Release Models

Upload Models   Manage Models   Release Models
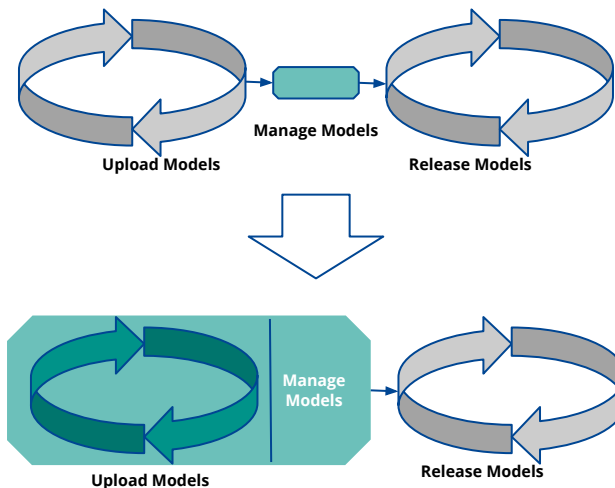
Model Upload Mock
Changes (Predictions Tab)

Prediction Management
eldrick.wega

Upload	Predictions	Groups	Workflows	Git	Models	Releases

approvalmodels-golf01   × ▾

1-100 of 192 records   ★

IDs	Content Type	Funnel From	Funnel To	Offer Type	Platforms	Surfaces	Sections	Darwin	Tags	Item Facts	Name	Models	Lookalike
Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾	Select ▾
chaseUnitedExpl	Eligibility	Application	Approval					golf.01	ApplicationToAp		InkBusiness_App	3 Model(s)	No
regions_PQ2	Eligibility	Application	Approval					golf.01	ApplicationToAp		Constant_ninety	3 Model(s)	No
CCCitiBank1312	Eligibility	Application	Approval					golf.01	ApplicationToAp		CCCitiBank1312	3 Model(s)	No
CCCreditOneBa	Eligibility	Application	Approval					golf.01	ApplicationToAp		CCCreditOneBa	3 Model(s)	No
Lightstream_Ref	Eligibility	Application	Approval					golf.01	ApplicationToAp		Lightstream_Ref	3 Model(s)	No
CCAmericanExp	Eligibility	Application	Approval					golf.01	ApplicationToAp		CCAmericanExp	3 Model(s)	No
chaseMarriottPre	Eligibility	Application	Approval					golf.01	ApplicationToAp		chaseSapphirePr	3 Model(s)	No
CCBankofAmeri	Eligibility	Application	Approval					golf.01	ApplicationToAp		CCBankofAmeri	4 Model(s)	No
BankOfAmerica_	Eligibility	Application	Approval					golf.01	ApplicationToAp		BankOfAmerica_	3 Model(s)	No
Mariner_2, marin	Eligibility	Application	Approval					golf.01	ApplicationToAp		onemain_AppTo	3 Model(s)	No
moneymanagem	Eligibility	Application	Approval					golf.01	ApplicationToAp		moneymanagem	3 Model(s)	No
CarFinance_refi	Eligibility	Application	Approval					golf.01	ApplicationToAp		CarFinance_refi_	3 Model(s)	No
CCCitiBank1859	Eligibility	Application	Approval					golf.01	ApplicationToAp		CCCitiBank1859_	3 Model(s)	No
chaseFRE, chase	Eligibility	A	Approval					golf.01	CreditCards, App		chaseFreedom_,	3 Model(s)	No
CCAmericanExp	Eligibility	A	Approval					golf.01	ApplicationToAp		CCAmericanExp	3 Model(s)	No
CCAmericanExp	Eligibility	A	Approval					golf.01	ApplicationToAp		CCAmericanExp	3 Model(s)	No
regionalLarge_1,	Eligibility	Applicati	Approval					golf.01	regionalLarge_1,		onemain_AppTo	3 Model(s)	No
CCBarclays1213	Eligibility	Appli	Approval					golf.01	ApplicationToAp		CCBarclays1213_	3 Model(s)	No
CCAmericanExp	Eligibility	A	Approval					golf.01	ApplicationToAp		CCAmericanExp	3 Model(s)	No
CCAmericanExp	Eligibility	lication	Approval					golf.01	ApplicationToAp		CCAmericanExp	3 Model(s)	No
Upstart_PQ	Eligibility	Application	Approval					golf.01	ApplicationToAp		Constant_ninety	3 Model(s)	No
Edit	E	Edit	Edit		Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit

Remove this button and use the modal it links to in the "Upload Prediction" page

Move this button to the "Upload Prediction" page

Previous   Page 1 of 2   100 rows ⬍   Next

Export   Create   Import   Bulk Delete

Model Upload Mock
Changes (Models Tab)

Prediction Management   eldrick.wega

| Upload | Predictions | Groups | Workflows | Git | Models | Releases |

1-100 of 1567 records   ★

Model	Type
CCCitiBank1299_impToClick_bestcc_refresh_scorelimited.xml	Pmml
all-ids_cta_all-site_hotel_20171102.xml	Pmml
Milestonegold_ImpToClick_GBTLogReg_expl_20170531_scorelimited.xml	Pmml
ClusterFour_200Features_Stacked_itc_bestcc_20180904_scorelimited.xml	Pmml
NetCredit_ImpToClick_GBTLogReg_expl_20170531_scorelimited.xml	Pmml
RateGenius_Refi_OfferTier_CaseWhen_20151217.xml	Pmml
CCBankofAmerica03_BTAPM_CaseWhen_20170308.xml	Pmml
all-ids_ImpToClick_RF_itemid_locationid_travel_CC_Marketplace_hardcoded_20170822_scorelimited.xml	Pmml
ScikitXGBoostBuilder__App_to_Appr_CC_CCCapitalOne1007_vega_hummer-01__20190319.xml	Pmml
ClusterThree_200Features_itc_dashboard_20181029.xml	Pmml
CCCitiBank1299_xgboost_fiesta-02_prophecy.xml	Pmml
CCCitiBank1306_BTDuration_CaseWhen_20151105.xml	Pmml
lend_up_itc_dashboard_20171109_scorelimited.xml	Pmml
subprimeCards_EmailRecvdtoConv_rf_011518.xml	Pmml
Constant_near_zero_cccreditonebank04.xml	Pmml
Nationwide_Refi_OfferTier_CaseWhen_20151217.xml	Pmml
Milestonegold_ClickToAppl_GBTLogReg_20...	Pmml
$prop_constantNinetyFive	Code

Move this button to the "Upload Model" page

| Previous | Page | 1 | of 16 | 100 rows ⇕ | Next |

Add Model

Model Upload Mock
Changes (Upload Tab) New!

Prediction Management

eldrick.wega

| Upload | Predictions | Groups | Workflows | Git | Models | Releases |

Upload Prediction

Upload Model

Model Upload Mock
Changes (Upload Prediction) New!

Prediction Management

eldrick.wega

| Upload | Predictions | Groups | Workflows | Git | Models | Releases |

Create Prediction

Item Ids:
Select

Content Type:
Select

Darwin:
Select

Funnel From:
Select

Tags:
Select

Funnel To:
Select

OR

Item Facts:
Select

Offer Type:
Select

Name:

Platforms:
Select

Variance:
.33

Surfaces:
Select

Default:
.5

Sections:
Select

Import Prediction

Import

Description:

Attach Model(s)
- Model X   Delete

Upload Prediction

"Upload Prediction" Interface w/ following capabilities:
1. Create/Import Prediction
2. Link/Attach existing Model

Model Upload Mock
Changes (Upload Model) New!

Prediction Management   eldrick.wega

| Upload | Predictions | Groups | Workflows | Git | Models | Releases |

Import Model

Add Model

Model Name: [   ]

Your Features:

| Feature X | Feature X | Feature X | Feature X | Feature X | Feature X | Feature X |

Re-train

Upload Model

"Upload Model" Interface w/ following capabilities:

1. Create Model

2. See Features (based on model file)

3. Automated or assisted feature validation*

4. "Train model" button to train the model on the spot

*Automated - Block "invalid" features from being used

Assisted - Highlight Vega analysis of feature to make user aware

2nd Improvement Areas - Model Release
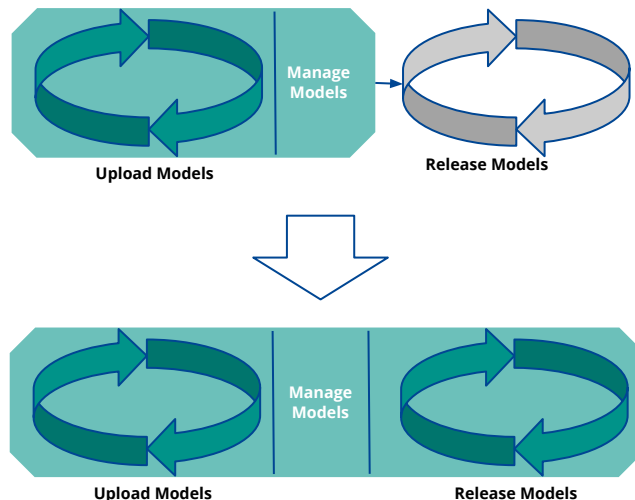**100 ft view**

Model Deployment | RP-2903

- Transition from manual to automated deployment
- Set up periodic jobs (integration with Prophecy)

Model Scoring | RP-3403

- Visibility of model performance/accuracy

Model Refresh | RP-3404

- Ability to edit features for existing models without having to restart
- Perfect scenario: Automatic model refreshes

Model Release Mock
Changes (Prediction Tab)

Model Release Mock
Changes (Edit Prediction) New!

Prediction Management

| Upload | Predictions | Groups | Workflows | Git | Models | Releases |

Prediction [91d5350b-e724-439a-b192-c900547a9667]

This page accessed when double clicking on prediction

Description:

Last Updated:

20XX-XX-XX

Button leads Looker Dashboard/Other Page that has visualization of live scoring

Prediction Metrics

Item Ids:
× CCAmericanExpressCard101   × ▼

Content Type:
Funnel   × ▼

Variance:
0.33

Darwin:
× NANTUCKET.02   × ▼

Funnel From:
Click   × ▼

Default:
0.5

Tags:
× RecSys   × CCAmericanExpressCard101   × ▼

Funnel To:
Application   × ▼

Models:
• cta_unified_all_feature_noitemfact

Override Model(s)

Item Facts:
itemFact_CCAmericanExpressCard82   × ▼

Offer Type:
Select   ▼

Name:
CCAmericanExpressCard82_ClickToAppl_RF_20170607

Platforms:
× web   × android   × mweb   × ios   × ▼

Surfaces:
× cc-marketplace   × ▼

Sections:
× top-pick   × ▼

Submit   **Delete**

Model Release Mock
Changes (Edit Model) New!

Prediction Management

eldrick.wega

| Upload | Predictions | Groups | Workflows | Git | Models | Releases |

Model e92e23fd-af97-48b5-a366-8df23043dc54

Features:

Feature X   Feature X   Feature X   Feature X   Feature X   Feature X   Feature X

Re-train and Submit   Delete

This page accessed when double clicking on model

3rd Improvement Areas - Quality of Life
100 ft view

Ease of Use & Visibility | RP-3405

- Continuous improvement of UX functionalities
- Bugfixes
- Scaling operations
- "Sharpening the edges"
- UI improvements
- Graphical visualization of model performance
- Beauty enhancements
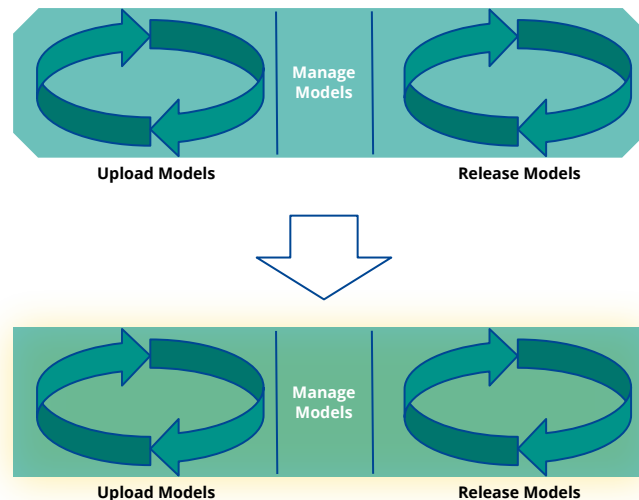
QoL Mock
Changes (Tab format)

Predictions	Groups	Workflows	Git	Models	Releases

Upload	Manage			Release
	Predictions	Models	Git	

Put the Group functionalities under the Predictions tab

Put the Workflow functionalities under the Git tab
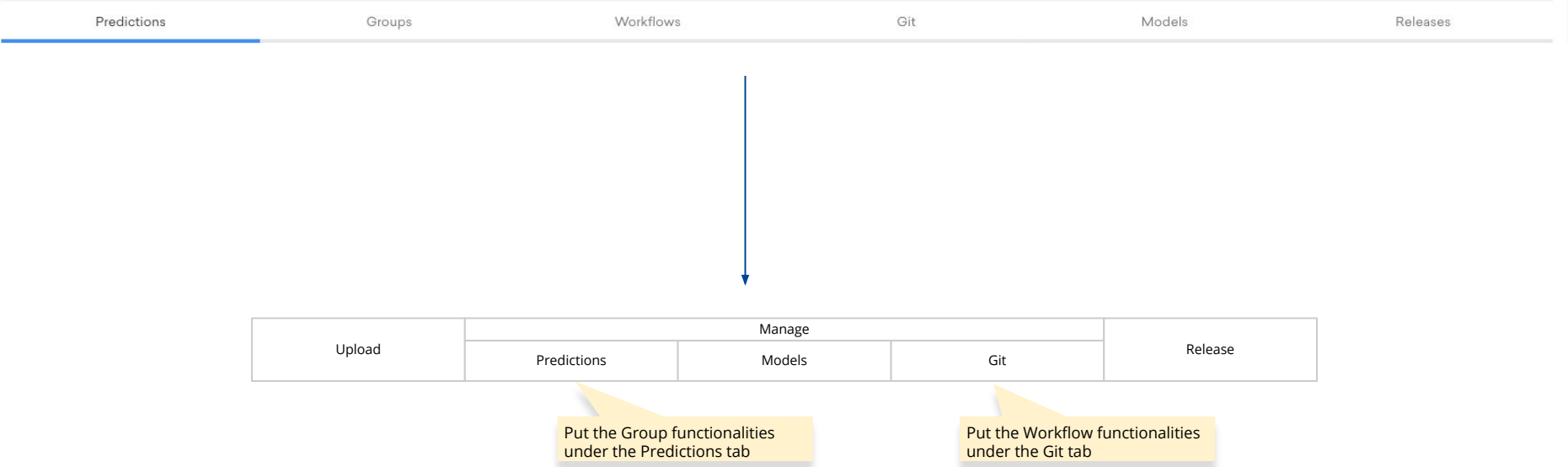
QoL Mock
Changes (Predictions Tab)

New button to lead to "Groups" page

Edit Groups

Group ▼

Ability to show models without being in specific group

No Records   ★

IDs	Content Type	Funnel From	Funnel To	Offer Type	Platforms	Surfaces	Sections	Darwin	Tags	Item Facts	Name	Models	Lookalike
Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼	Select ▼

Need to callout that these are bulk edits/selections

No rows found

Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit	Edit

Previous   Page 1 of 1   100 rows ⇕   Next

Bulk Delete

QoL Mock
Changes (Git Tab)

Status	History	Workflow

You are up to date with master

Unable to merge, you need to revert!!! sorry :(

1-2 of 2 records ★

Lookalike Location Lookalike

Time	Description
2019-04-02T19:49:02Z	3 group addition(s) and 3 group removal(s) and 1 group change(s) and 597 prediction addition(s) and 94 prediction removal
2019-04-11T18:34:11Z	1 group change(s)

Previous	Page 1 of 1	100 rows ⬍	Next

Commit

Revert

+ Others based on user needs!

Thanks!

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Appendix

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Roadmap of PMUI

1,000 ft view

Q1-Q2 Roadmap		Q3 - Q4 2019 Onwards
Completed	Future of Q1-Q2	

1

"Meat and Bones" Framework for PM Tool (P0 Requirements)

- User Interface setup
- Ability to hold and deploy models with PMML files
- Git-style operation method allowing staged edits

2

"Armor" Framework (P1 Requirements)

- **Enhancements** of functionalities
- Manual inputs => **Automation**
- **Admin** Hierarchy
- Greater **Visibility** for users

3

"Magic" Framework (Down-the-Road)

- Completely automated workflow
- Direct Integration w/ model performance tracking
- Models can be interfaced with easily from UI (think Darwin experiments)

Prediction Management Objectives	Provide a Modelling Management interface with self-serving capabilities across Data Science teams

"Armor" Framework: Future of Q1 - Q2 | Themes

100 ft view

Should-have

Nice-to-have

General Enhancements
- More range of capabilities in what the tool can do, and should block. (e.g. Support upload of non gziped model files)

Automation
- Making processes automatic.

Administrative Hierarchies
- Set up an admin and peer feedback infrastructure, specifically in the "Git" environment. (e.g. conflicts and rollback)

Visibility
- Allow /feedback to users on where they are in the system, assistance to their workflow (i.e. straightforward UI and better UX)

"Scrum Board": https://docs.google.com/spreadsheets/d/1Vi75BU636T72x4h5ow7TFHa4NpgahBi4QjXZ2fflV3w/edit#gid=0