Push straight to prod
API development with R and TensorFlow at T-Mobile

rstudio::conf
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What does it mean to put into production?

ANALYSIS
Running code once to produce a result

BUILD
Writing code that is continuously running

Putting code into production is letting customers interact with it
The project:

**Goal** Use machine learning to improve the customer experience

**Scope** customer care messaging
Scenario Customer sends message: “This high bill shall not pass!”

Goal Prep customer care agent before first response: Current bill status

Method
- Classify the message with machine learning: [bill breakdown]
- Improve the prediction with customer data:
  - Recent account activity
  - Signal strength
  - Bill status [overdue]
Model creation with R
Model building workflow

1. rmarkdown for exploratory analysis

2. Save the model to flat files (and log the build with rmarkdown)

3. Show model off with a shiny demo
A Convolutional Neural Network (CNN) processes initial customer message and customer data.

```
“Unlock my phone.”
```

```
Recent order: YES
```

```
ACCOUNT  UNLOCK  ORDER
0.05      0.80    0.15
```
Intent model demo

message
I want to unlock my phone

element sms
[No SMS]

element aal
[no aal]

Developed by the AI @ T-Mobile team. For details please contact James Ellison.
Model deployment to prod
Choosing the language

“If you want machine learning in production you need Python” –literally everyone

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<tr>
<th>Option</th>
<th>Analysis</th>
<th>Modeling</th>
<th>Deployment</th>
<th>Verdict</th>
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Idea! Treat R like a full programming language

(commit is one)
Turning R into an API: plumber

Create an R file for the API endpoints

Start the plumber service

Now make HTTP requests to R!

rest_controller.R

```r
## @get /sum
function(a, b){
  as.numeric(a) + as.numeric(b)
}
```

main.R

```r
library(plumber)
r <- plumb("rest_controller.R")
r$run(host='0.0.0.0',port=80)
```
Behold: containers!

- **Dockerfile**—build instructions
- **Image**—the result of the Dockerfile
- **Container**—Hitting run on an image

**Example Dockerfile**

```bash
# start from the rocker/r-ver:3.5.0 image
FROM rocker/r-ver:3.5.0

# install the linux libraries needed for plumber
RUN apt-get update -qq && apt-get install -y 
    libssl-dev 
    libcurl4-gnutls-dev

# install plumber
RUN R -e "install.packages('plumber')"

# copy everything from the current directory into the container
COPY / /

# open port 80 to traffic
EXPOSE 80

# when the container starts, start the main.R script
ENTRYPOINT ["Rscript", "main.R"]
```
Container Struggles: Python

R Keras requires Python

- Added Python 3.6 (Anaconda) and Python Keras installation to Dockerfile
- Configured Reticulate to use correct Python
Container Struggles: Security

Plumber does not support HTTPS
  • Added an Apache 2 server to reroute

Text needs encryption
  • Sodium R library
Container Struggles: Size

Initial size (5+ GB)

- Switched Pythons
  (Anaconda → Miniconda)
- Removed Rstudio
  (rocker/tidyverse → rocker/r-ver:3.5.0)
- Removed unnecessary Linux, R, Python libraries
Status: UP

- R-native API container
- TensorFlow enabled
- Lightweight
- Secure
Lessons learned
R vs Python

• R & Plumber close to parity with Python & Flask
• R advantageous for quick data exploration
• Language was never the project failpoint
Working Together is Critical
Where are we today
R in prod: Apple Business Chat

“Can I please pay my bill”  ➔  R  ➔  Customer
And you can be here too!
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twitter: @skyetetra @heatherklus

WE ARE HIRING!!