Data Science Capstone Project

April 23, 2021

Cutting Server Costs with Machine Learning

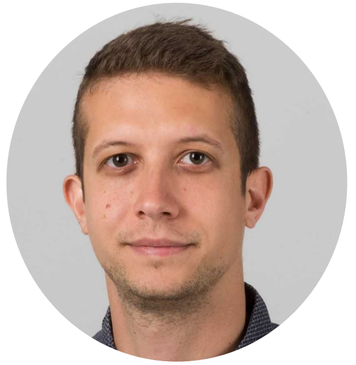
Maritsa Norton & Gianluca Macauda

{Propulsion}

The team

MARITSA NORTON

- 7 years’ strategic analytics in tech (Expedia / OpenTable)
- Background in economics



GIANLUCA MACAUDA

- Spent last 7 years in research
- Background in cognitive neuroscience and psychology

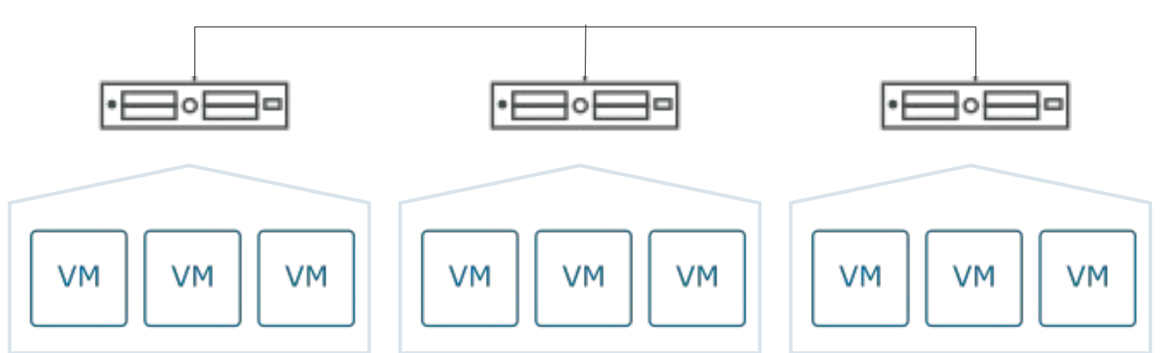
Introduction to CodeNotary

Many companies rely on advanced server platforms to run their business applications.

CodeNotary provides immutable database management and monitoring services that sit on top of these server platforms.

Fig. 1: Simplified NUMA server architecture

Servers
the physical machines that manage the VMs



Virtual machines (VMs)
Run business applications for this type of server architecture

Default settings can lead to **misconfigurations** of the server settings and thus **inefficiency**.

Opportunity to help clients reduce server costs

Undiagnosed server
misconfiguration

- Slow applications
- High costs (adds approx. 20% to budget)

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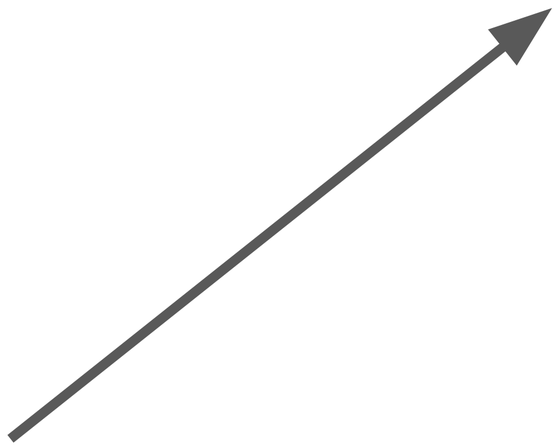

Option 1: **Buy more servers**

- Expensive
- May not solve root problem

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+ Lower costs in the long term
- Requires downtime and expertise
- Cannot quantify expected outcomes

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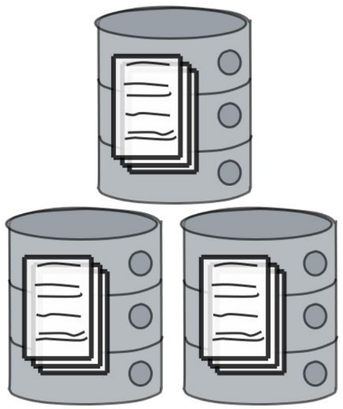
The goal & the approach:

Machine Learning to forecast server inefficiency

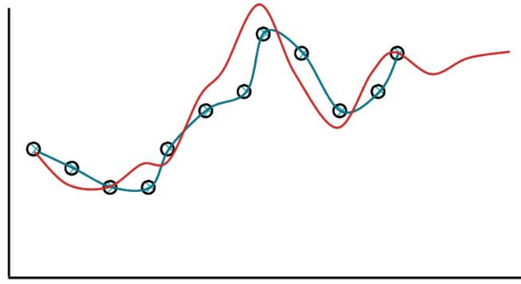
Datasource



Configuration settings and **performance** measures for:

5,406 **Virtual machines (VM)** on 230 **Servers**

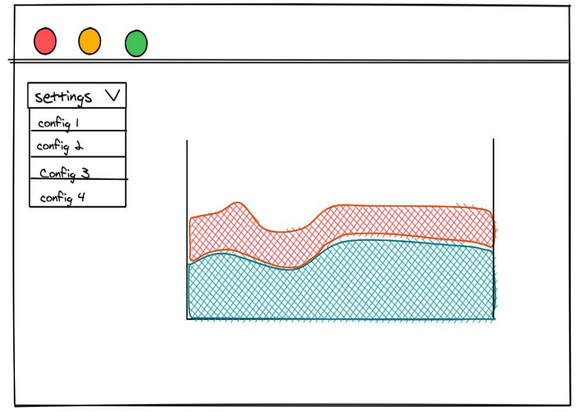
Efficiency Forecasting: Predictive Modeling



Forecast individual VM efficiency
Capture the dynamics of the system

Forecast aggregate server efficiency
Quantify the business impact of specific configuration changes

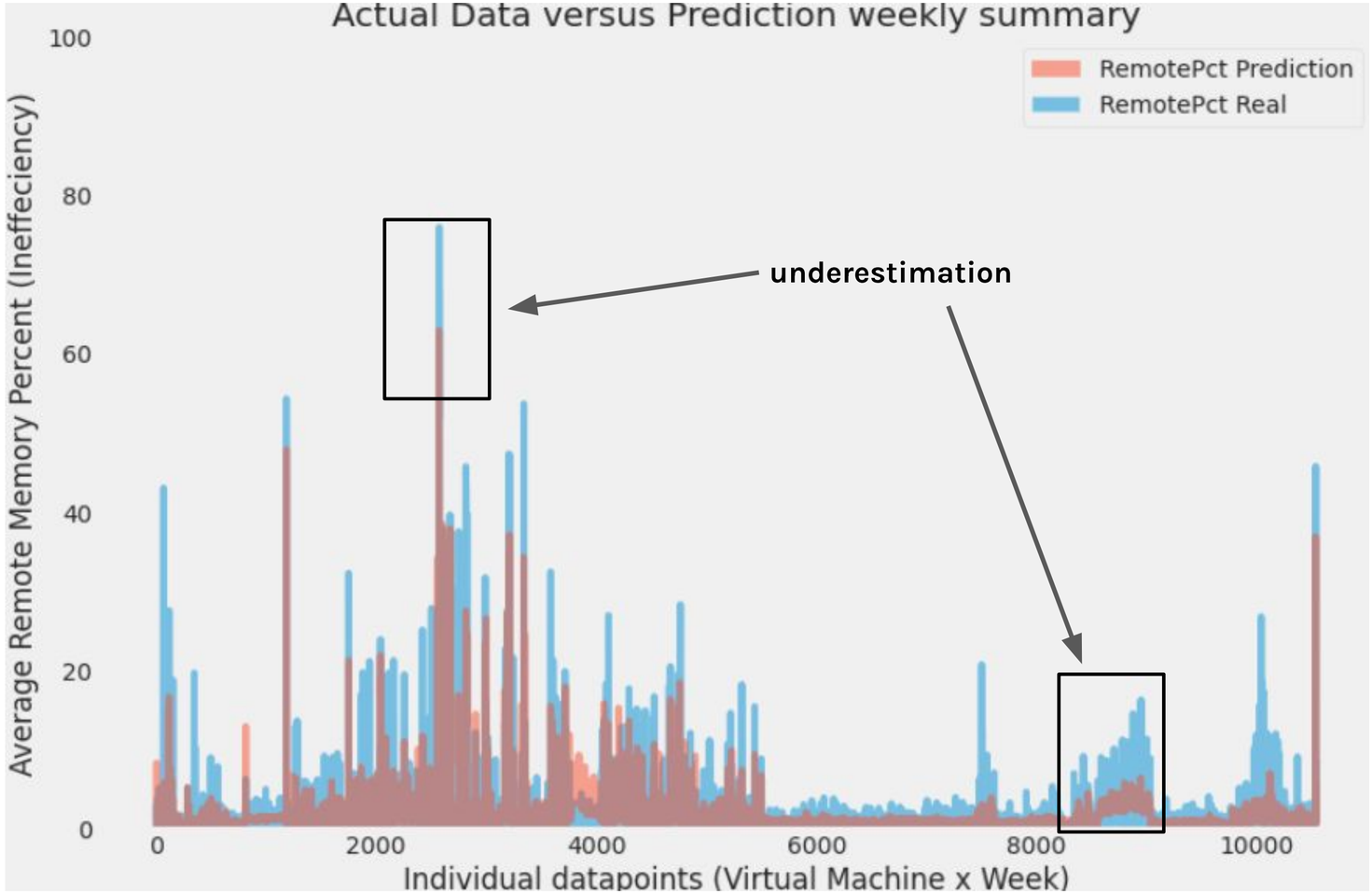
Application



1. **Quantify** the impact of **configuration changes**

Modeling & evaluation:

Predicting each individual virtual machine's weekly efficiency



Model insights

+ Model can **capture** most of the patterns

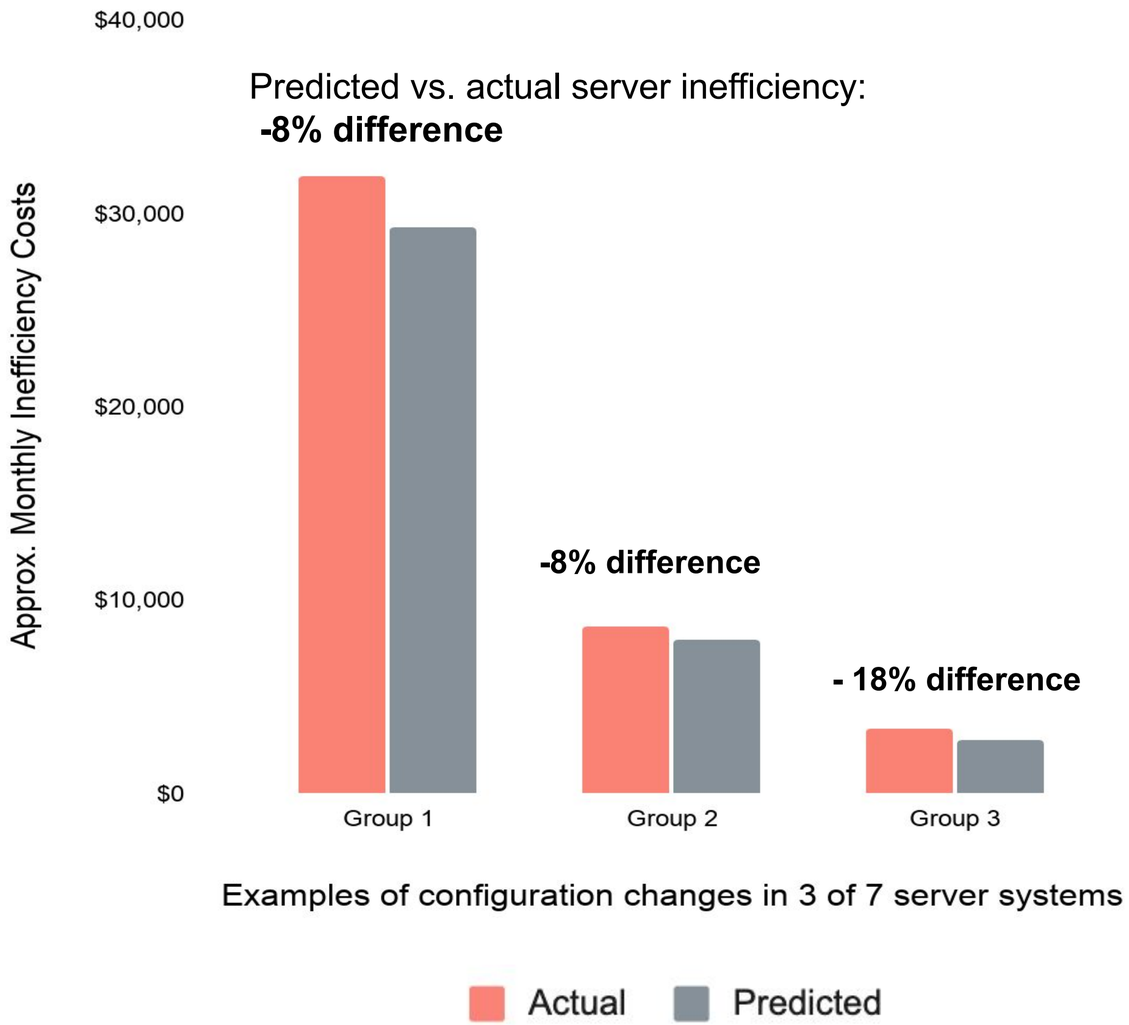
- **Underestimation** of real inefficiency

Proof of concept

Can we use these modeling techniques to predict efficiency gains after a configuration change?

Proof of concept:

ML model to predict $$ impact of simple configuration changes



+ Predictions underestimate the system's actual inefficiency by -8 to -18%
  + **Supports a cost-benefit assessment** of proposed configuration changes (*for VM-level changes to poorly configured platforms)*

Proof of concept:

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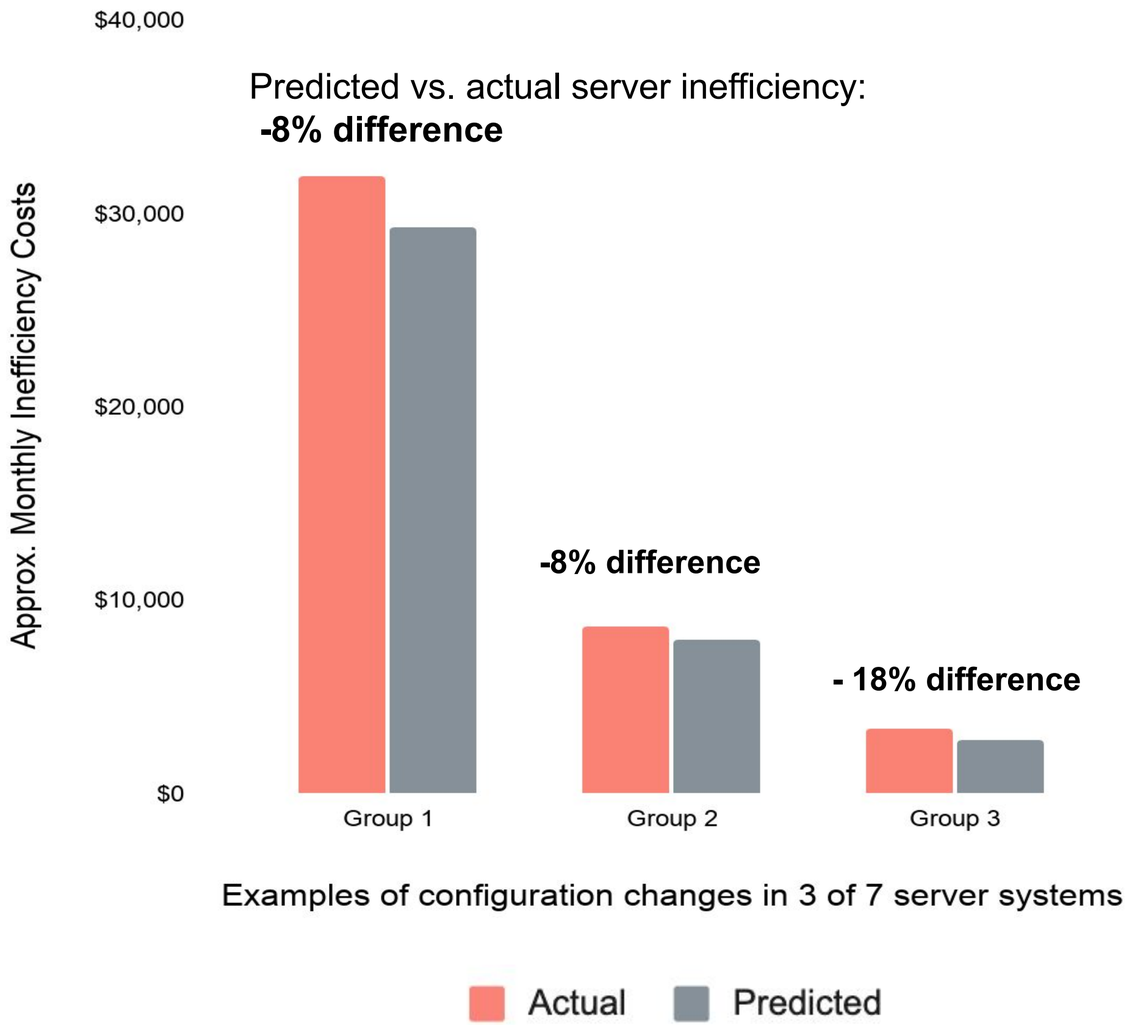


+ Predictions underestimate the system's actual inefficiency by -8 to -18%
  + **Supports a cost-benefit assessment** of proposed configuration changes (*for VM-level changes to poorly configured platforms)*

- Room to improve accuracy
- Only useful for VM configuration changes on very inefficient systems

Takeaways

Link VMs to servers

- Connection of VM and server settings are critical
- Current stage: No possibility to connect them in satisfactory way

Imbalanced dataset leads to a “biased” model

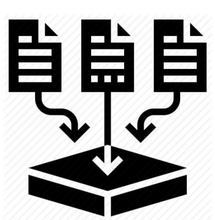
- One client had no inefficiency problems (Average Inefficiency = 1.19%)
- Clients with efficiency problems & more sophisticated modeling approaches

Promising efficiency forecasting (3 clients)

- mean absolute error around 1%
- For **inefficient VMs** (VMs of interest): average **underestimation of 6%**

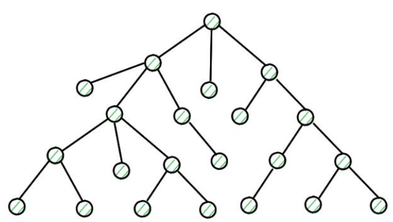
Next Steps & Outlook

Data collection



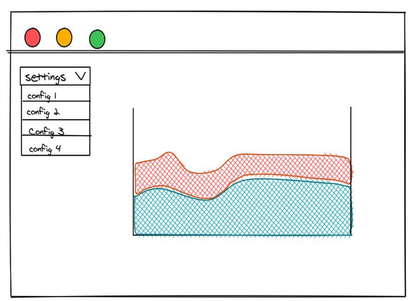
1. Diverse data
2. Link Servers to VMs

Modeling



Capture dynamics of servers and VMs

Application



Case-specific predictions

Dynamic simulations of configuration changes

Next Steps & Outlook

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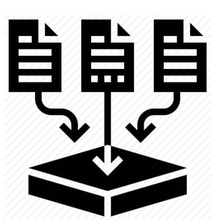

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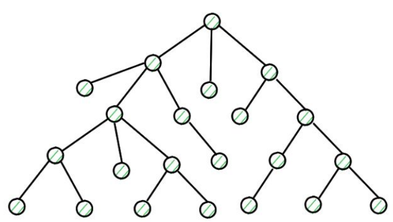

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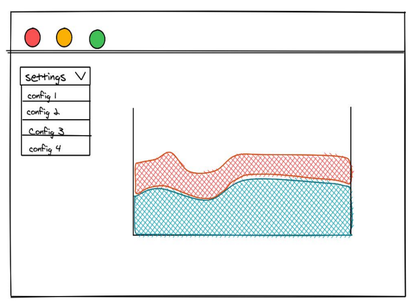

Case-specific predictions

Dynamic simulations of configuration changes

Novel tool to help organizations stop wasting money

Thank you

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