THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

KUDOS DATA

Practical Data Science

Predictive Image Analysis Using Deep Transfer Learning

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Agenda

- Why Data Scientists Are Highly Paid ?
- Data Science vs. Machine Learning
- Ethical Challenges in Data Science & Prediction
- Predictive Image Analysis Using Deep Transfer Learning

Why Data Scientists Are Highly Paid ?

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Biz Domain Knowledge

Subject Matter Expert
($70k+)

Modeling Knowledge

Traditional Analyst
($60k+)

Programming Technical Skills

Software Engineer
($50k+)

...

Taste (Market)

Recipe (Model)

Sourcing (Software)

Cooking (Scaling)

...

Biz Strategy
Sales & Market
Finance
Competition

Biz Data Scientist
($90k+)

Data Science Engineer
($80k+)

Prod Support
Customer Care
Operation
Miscellaneous

Full Stack Data Scientist
($130k+)

Entrepreneur Data Scientist
($???)

Why Data Scientists Are Highly Paid ?

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A highly paid data scientist is a superman capable of:

- modeling using machine learning
- writing quality code (full stack / web master)
- designing data driven software architecture
- industrial domain knowledge
- explanation to layman business sponsor/customer (visualization and storytelling)
- workaround organizational red-tapes (even hostility)

Data Science vs. Machine Learning

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Data Science Elements:

- Framing Business Problem
- Data Acquisition & Preparation
- Exploratory Data Analysis
- Data-driven Modeling (machine learning, tools & techniques)
- Result Presentation & Visualization (actionable insights)

Machine Learning Elements :

- Task
- Experience (data)
- Performance

Ethical Challenges in Data Science & Prediction

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- New technology makes people's life miserable ?
- Sales Prediction
- Education / Medical Resource Allocation
- Data Science = Data-driven Discrimination ?

Predictive Image Analysis Using Deep Transfer Learning

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1. Deep Learning Basics for Image Analysis
2. Real World Image Analysis Needs
3. Idea of Transfer Learning
4. Architecture of Transfer Learning

---------- Short break / Workshop environment setup ----------

5. Hands-on Datalab Workshop on Google Cloud Platform (GCP)

1 Deep Learning Basics for Image Analysis (1)

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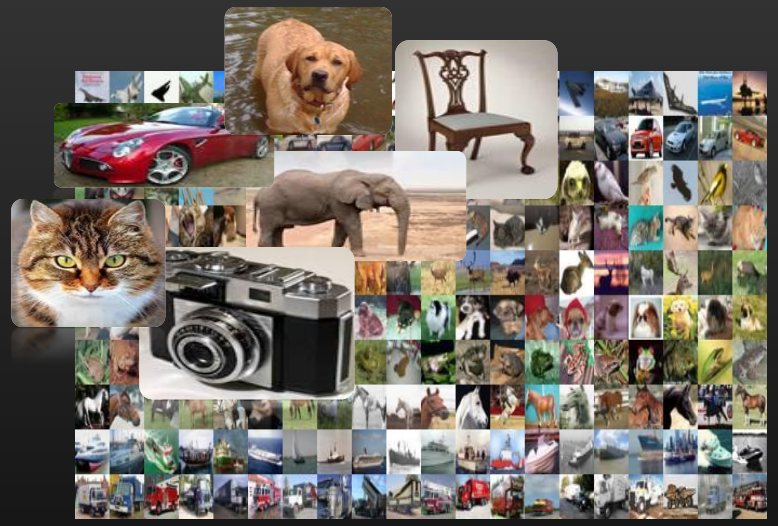
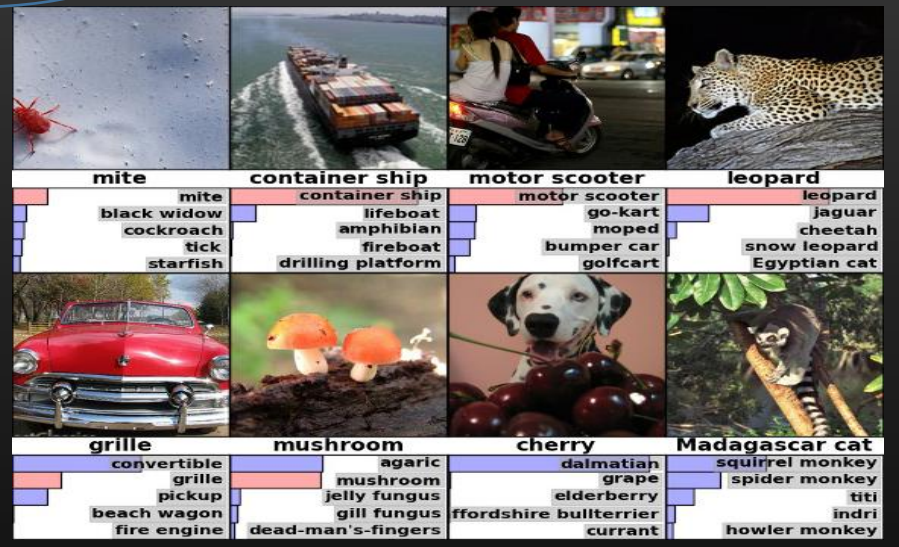
Please! Tell me the correct image category. **And how you did it?!**



Huge images as learning inputs (millions)

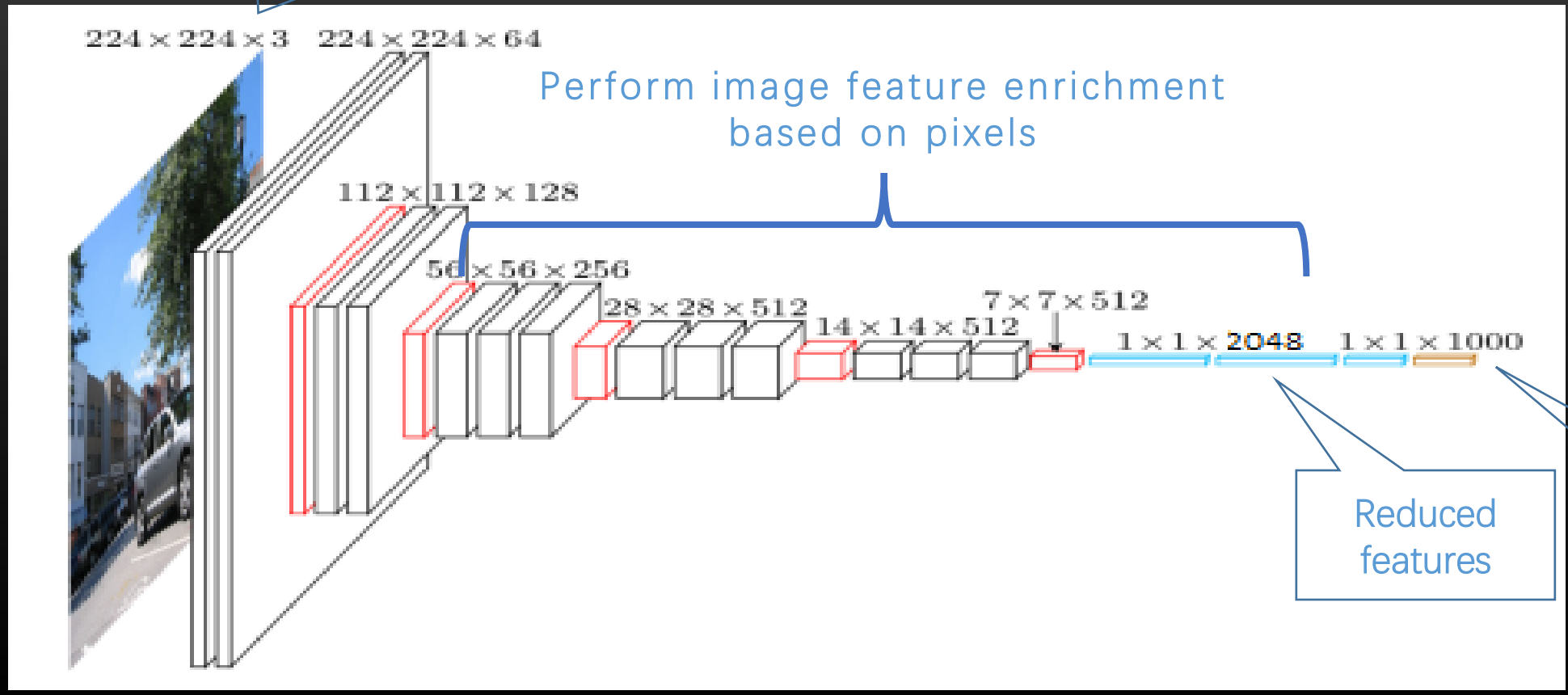
Deep Learning Magic Crystal Ball



Very accurate predicted class (1000 classes)

1 Deep Learning Basics for Image Analysis (2)

150,528 features per image
(224 x 224 pixels x 3 RGB channels)



2 Real World Image Analysis Problem

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In my workplace, I have some images of **healthy working valves** and **malfunctioned ones**. I'd like to explore the promising benefit of automatically monitor, classify and alert me if there is any anomaly happening in the industrial fields…

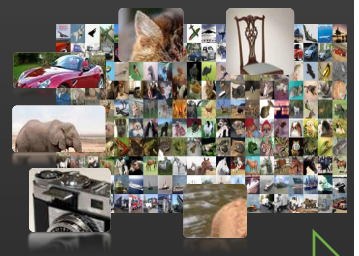



But I

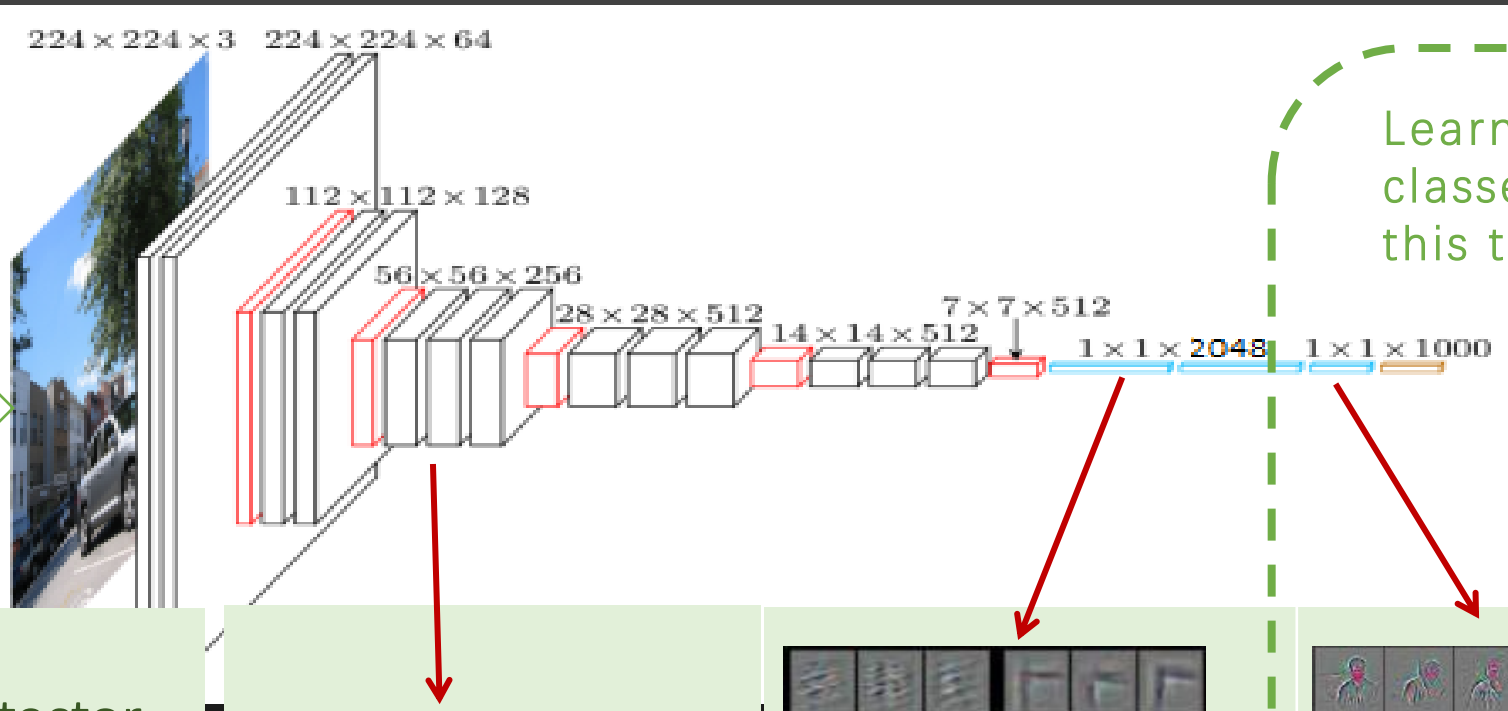
- Lack of powerful computing resources
- Difficulty to design network architecture and tune millions of hyper-parameters of deep neural network
- Lack of enough labeled images (around one hundred images)

Is there a solution?

3 Idea of Transfer Learning



Task of ImageNet

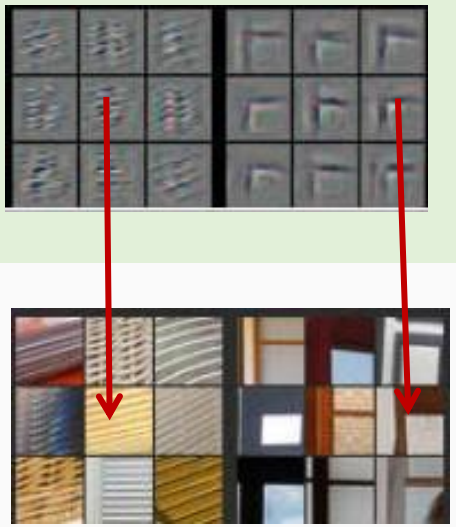


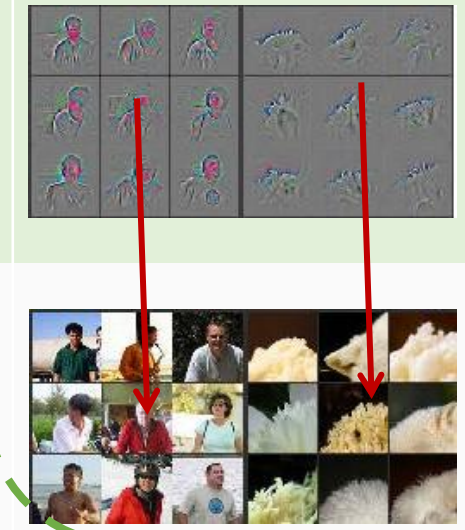
Learn and predict 1000 classes: Very specific to this task

Example of detector learnt in deep neural net

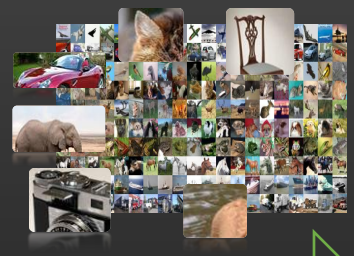
Example of matched pattern from individual image

[Zeiler & Fergus]

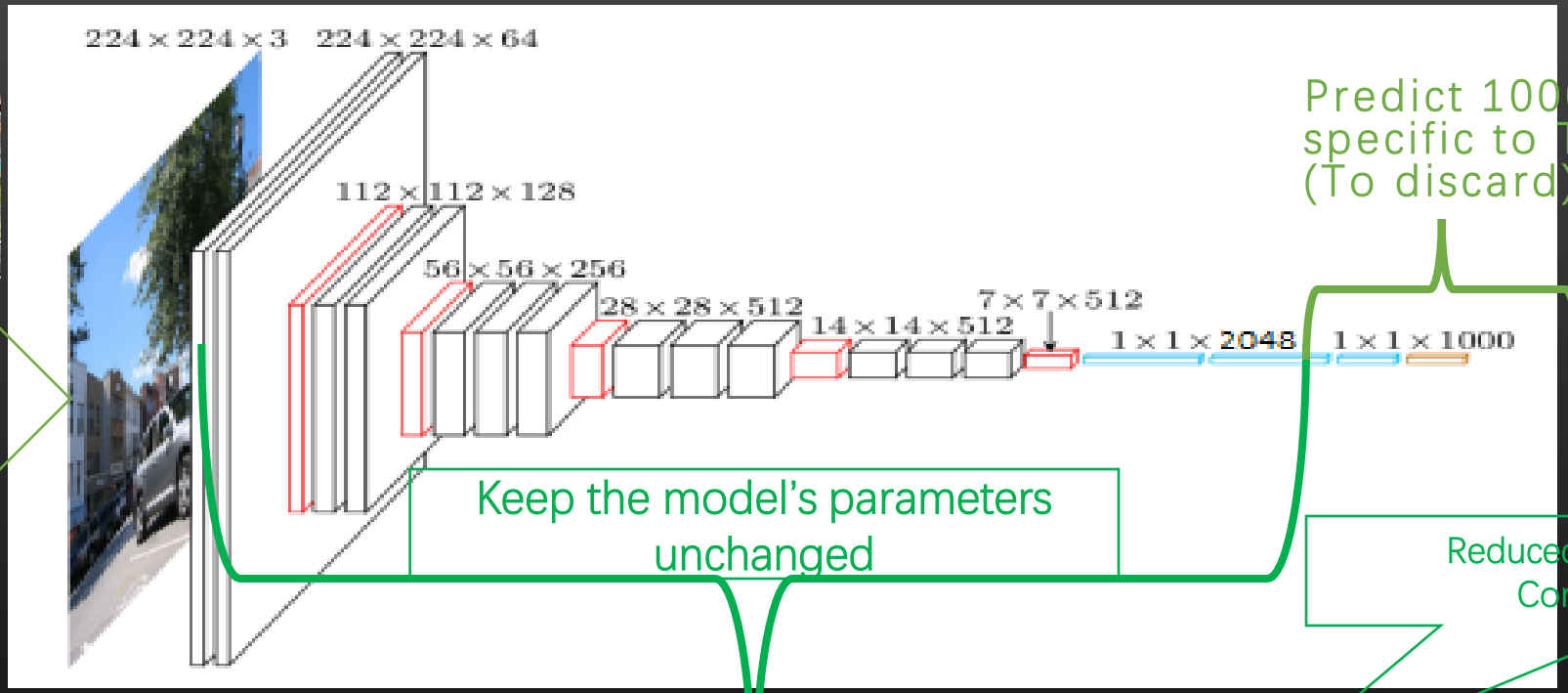




4 Architecture of Transfer Learning



Task1
ImageNet



Predict 1000 classes: Very specific to Task1 (To discard)

Keep the model's parameters unchanged

Reduced features per image: 2048
Concentration Ratio: 1.4%

Task2 Valves

Raw features per image: 150,528

Feature Extraction / Transformation (Reusable for Task2)

New Simple ML Model

Normal Valve

Abnormal Valve

5 Hands-on Datalab Workshop on GCP (1)

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Overview: In this lab, you will carry out a transfer learning example based on Google Inception-v3 image recognition neural network.

You will learn:

1. Explore images in customer's industry.
2. Reposition a pre-trained deep neural net for new image recognition task.
3. Perform feature extraction.
4. Obtain deep feature representation of customer's original image.
5. Train a simple machine learning model for new classification task.
6. Evaluate results of this transfer learning model.

Prerequisites:

- Google Cloud Platform Account
- Basic working knowledge of GCP, Datalab and Python

5 Hands-on Datalab Workshop on GCP (2)

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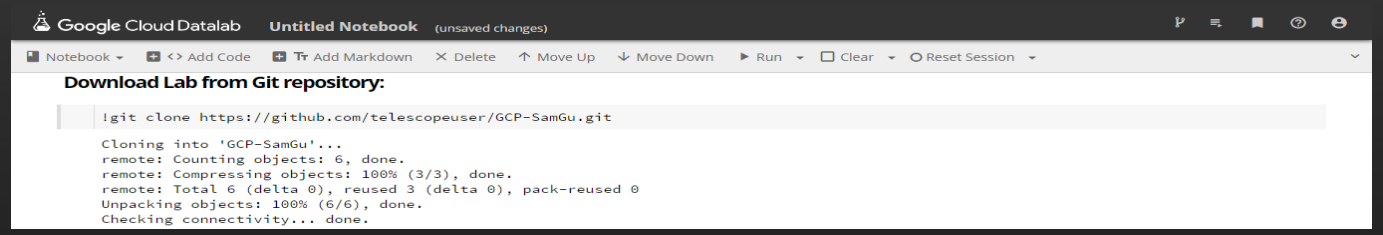
Steps to access lab workshop:

1. Login Google Cloud Platform to start Datalab.
2. Create a new notebook to download this lab by running command: !git clone https://github.com/telescopeuser/GCP-SamGu.git



3. Go to folder GCP-SamGu/Lab/, then open notebook Lab_Image_Analysis.ipynb to follow.

Reference:

- https://github.com/telescopeuser/GCP-SamGu
- Google Cloud Platform Free Registration
- Google Datalab Quick Start

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Thank you !
And you can help us by

Star our projects at:
https://github.com/telescopeuser

Write to participate in real world projects to democratize AI:
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WeChat