

Practical Data Science

Predictive Image Analysis Using Deep Transfer Learning

Instructor

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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 ?

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

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

- ❖ New technology makes people's life miserable ?
- ❖ Sales Prediction
- ❖ Medical Resources Allocation
- ❖ Data Science = Data-driven Discrimination ?

Predictive Image Analysis Using Deep Transfer Learning

1

Deep Learning Basics for Image Analysis

2

Real World Image Analysis Needs

3

Idea of Transfer Learning

4

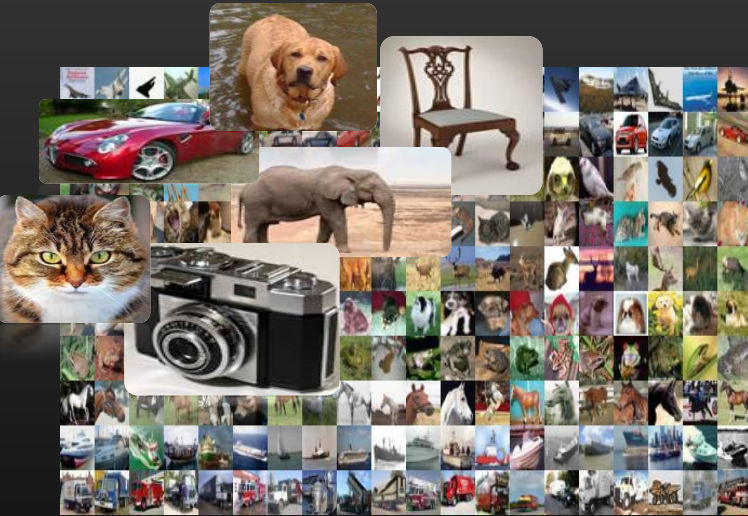
Architecture of Transfer Learning

5

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

1 Deep Learning Basics for Image Analysis (1)

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



Huge images as
learning inputs
(millions)



Deep Learning Magic
Crystal Ball

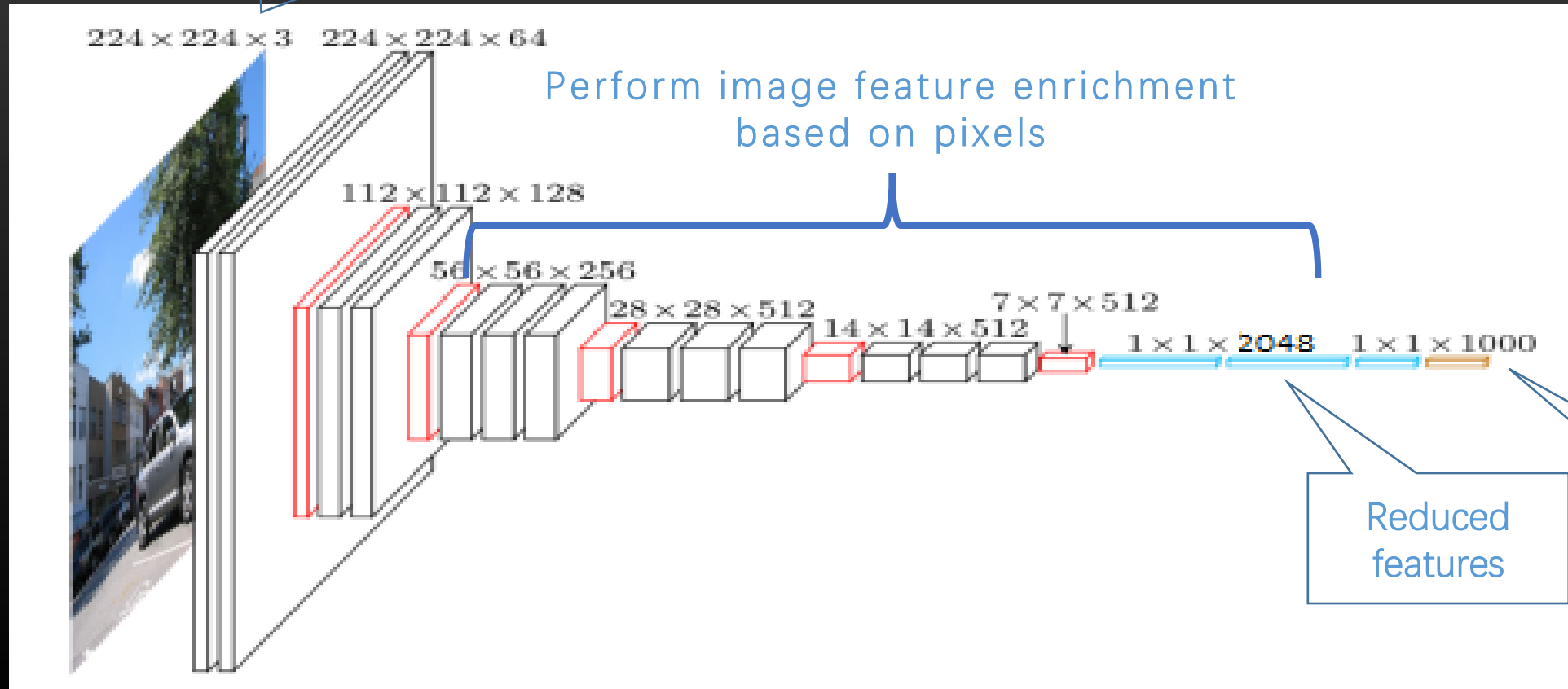


Very accurate
predicted class
(1000 classes)

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

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...

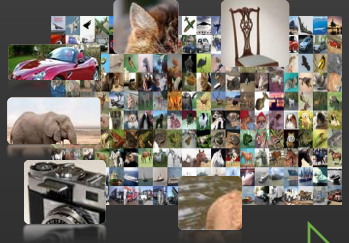


But I

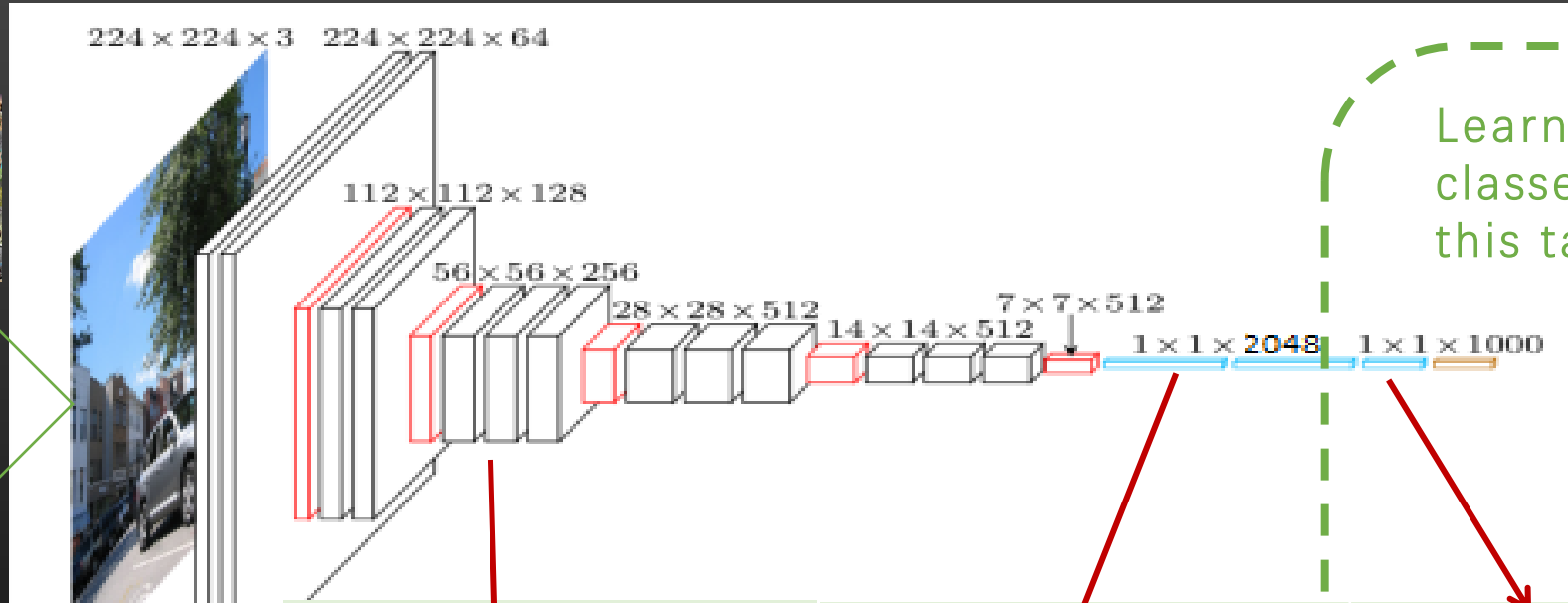
- Lack of powerful computing resources
- Difficulty to design network architecture and tune millions of hyper-parameters of deep neural network
- Lack of enough labeled images (around one hundred images)

Is there a solution?

3 Idea of Transfer Learning



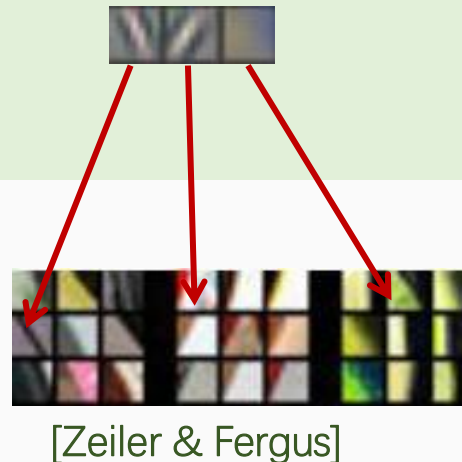
Task of ImageNet



Learn and predict 1000 classes: Very specific to this task

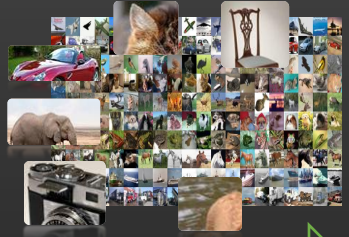
Example of detector learnt in deep neural net

Example of matched pattern from individual image

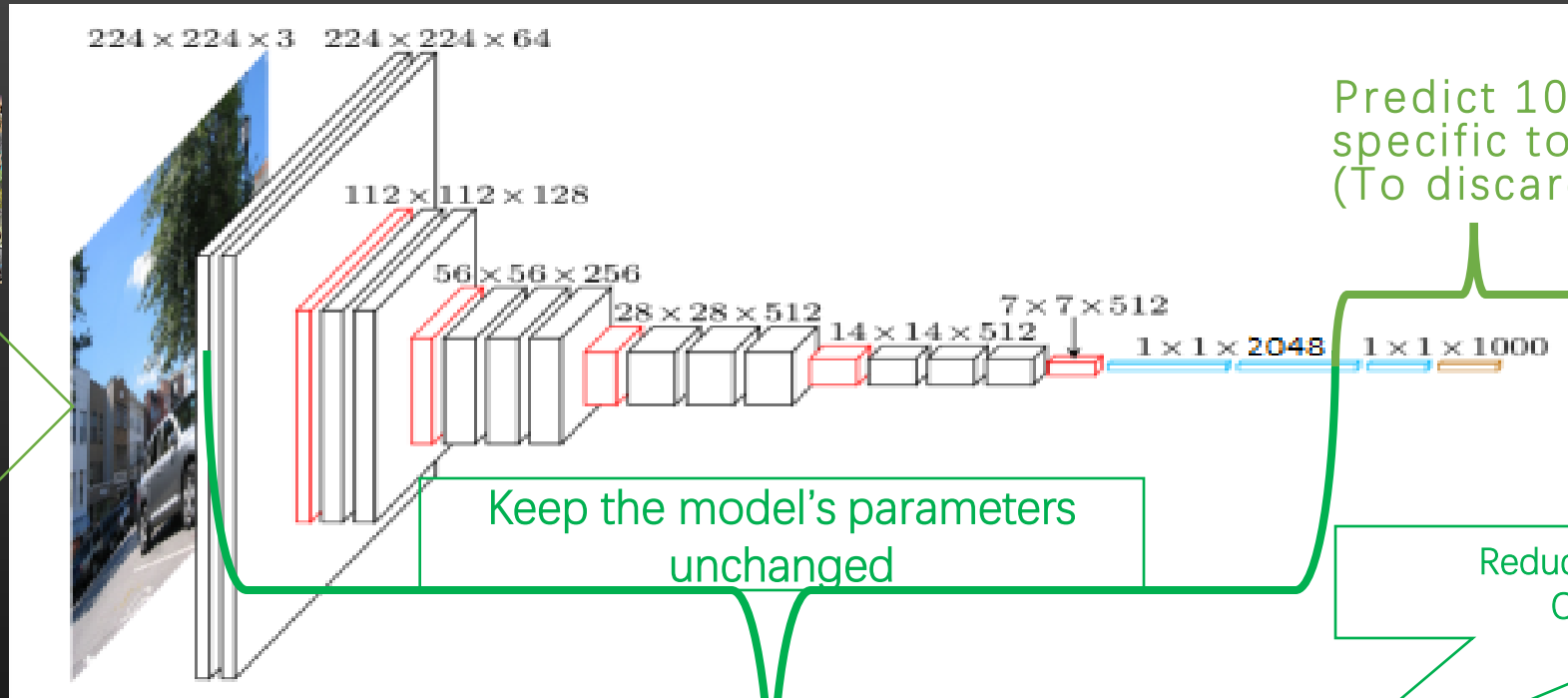


4

Architecture of Transfer Learning



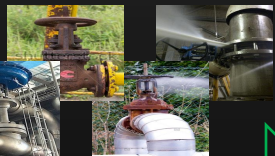
Task1
ImageNet



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

Feature Extraction / Transformation
(Reusable for Task2)

Raw features per image:
150,528



New Simple
ML Model



Normal
Valve



Abnormal
Valve

5

Hands-on Datalab Workshop on GCP (1)

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)

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`



Google Cloud Datalab Untitled Notebook (unsaved changes)

Notebook + Add Code + Add Markdown X Delete ↑ Move Up ↓ Move Down ▶ Run □ Clear ○ Reset Session

Download Lab from Git repository:

```
!git clone https://github.com/telescopeuser/GCP-SamGu.git
```

```
Cloning into 'GCP-SamGu'...
remote: Counting objects: 6, done.
remote: Compressing objects: 100% (3/3), done.
remote: Total 6 (delta 0), reused 3 (delta 0), pack-reused 0
Unpacking objects: 100% (6/6), done.
Checking connectivity... done.
```

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](#)

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

