



## Draft Proposal on Collaboration between IISc (BLR) & Aisin Seiki Co. Ltd (Japan) on Artificial Intelligence in FY2019

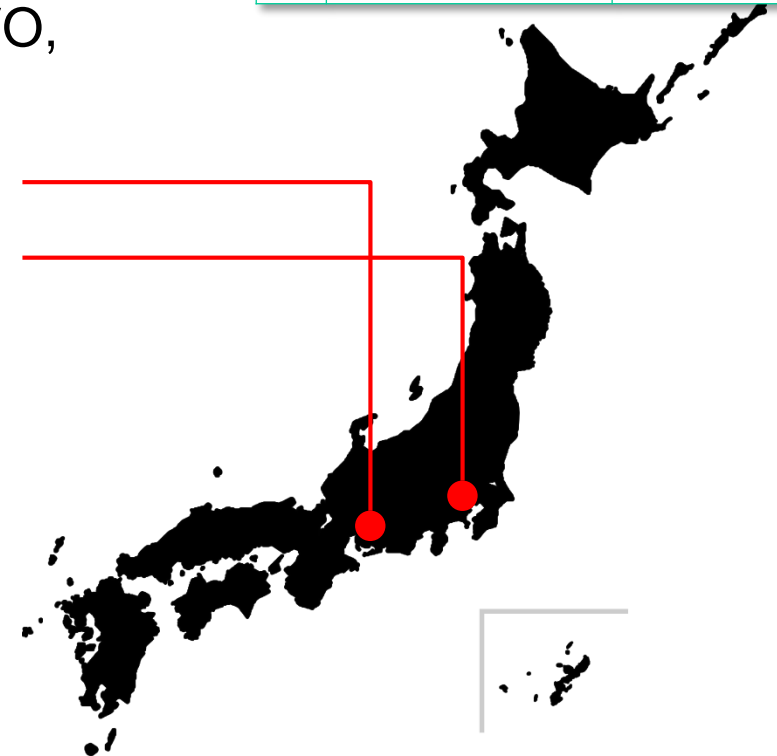
**11<sup>th</sup> Apr.2019**

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## What is **AISIN** ?

- The world **6th** automotive Tier-1 supplier
- Employees: **114,478** (consolidated)
- Main products: powertrain, chassis, vehicle safety system, body, ICT and electronics
- Main customers: **TOYOTA**, VW&AUDI, PSA, VOLVO, MITSUBISHI, SUZUKI and BMW
- Established in Aichi prefecture in **1965**
- Opened AI development center in Tokyo in **2017**
- Consolidated subsidiaries:  
**82** in Japan, **128** overseas

1	BOSCH	Germany
2	CONTINENTAL	Germany
3	DENSO	Japan
4	ZF	Germany
5	MAGNA	Canada
6	<b>AISIN</b>	<b>Japan</b>
7	HYUNDAI M.	Korea
8	BRIDGESTONE	Japan
9	MICHELIN	France
10	FAURECIA	France



# Strategy

- We are on the process of applying AI technologies for “Smart Factory” such as visual inspection for vehicle parts and time-series data analysis for equipment fault prediction
- Now, we are performing transformation in AI R&D dept.
- In the near future, we want to establish advanced AI technologies for “Connected” and “Shared” in car industry
- KEYWORDS: sharing-car management, personalization
- OUR STRENGTH: We are manufacturing over 80% of vehicle parts including many kinds of sensors (input) and actuators (output) EXCEPT automated-driving system which is struggled with by one of the same TOYOTA group, DENSO.



## **Purpose:**

To accelerate AI technology development by collaborating with IISc who has remarkable skill in AI such as

- ✓ Semi/Un-supervised learning
- ✓ Generative models
- ✓ Domain adaptation
- ✓ Deep reinforcement learning
- ✓ Interpretability

## **The Goal:**

- Establish new approach to unsupervised domain adaptation which guarantees its performance equivalent to Supervised Learning even if the dataset is imbalanced and/or small.
- Submit papers/posters to international conferences such as CVPR, NeurIPS, etc.

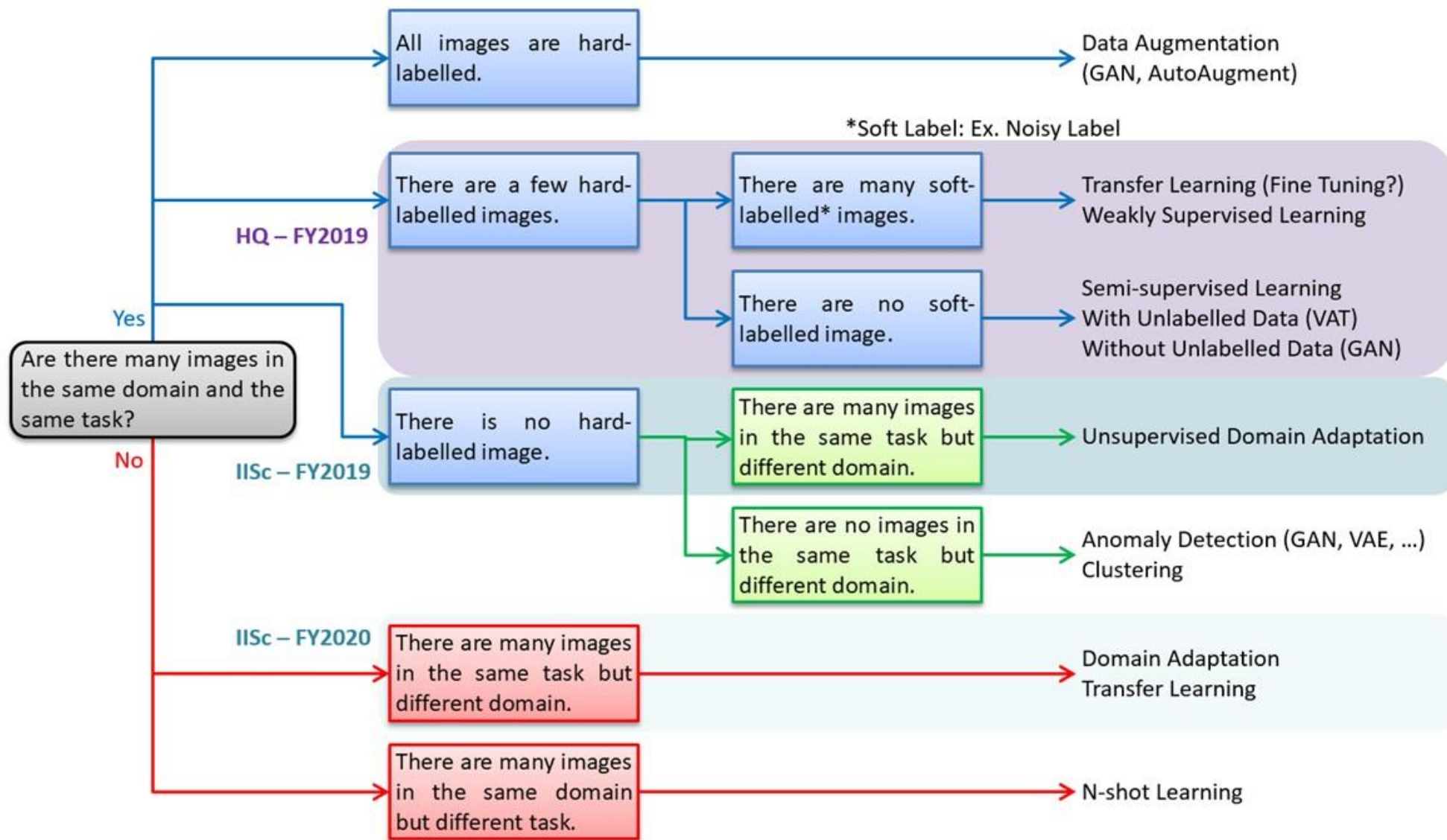
# Collaboration with IISc (2/6)



For a Better Tomorrow  
**AISIN GROUP**

**Domain: Sensor / Camera**

**Task : Identify NG parts (Welding, Crack, Hole, Bend,...)**



## A Previous Research

### Adversarial Discriminative Domain Adaptation (CVPR 2017)

Eric Tzeng (Univ. of California, Berkeley), Judy Hoffman (Stanford Univ.),  
Kate Saenko (Boston Univ.), Trevor Darrell (Univ. of California, Berkeley)

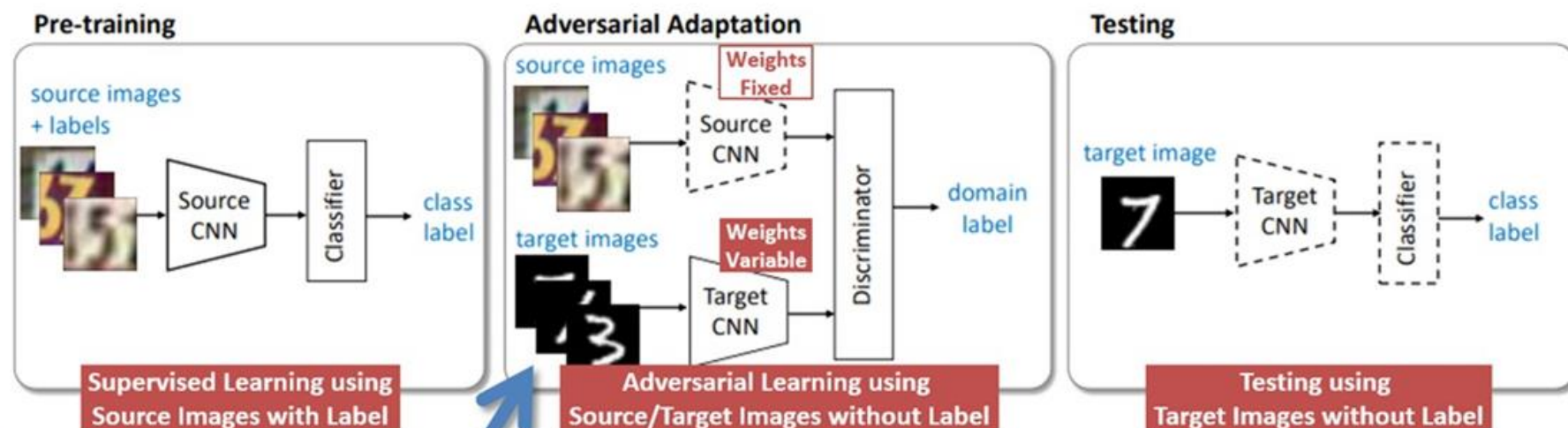


Figure 3: An overview of our proposed Adversarial Discriminative Domain Adaptation (ADDA) approach. We first pre-train a source encoder CNN using labeled source image examples. Next, we perform adversarial adaptation by learning a target encoder CNN such that a discriminator that sees encoded source and target examples cannot reliably predict their domain label. During testing, target images are mapped with the target encoder to the shared feature space and classified by the source classifier. Dashed lines indicate fixed network parameters.

**They were assuming that dataset is balanced and big.**

**However, dataset is sometimes imbalanced and small in real world.**

**So, we aim to unsupervised domain adaptation for imbalanced small data.**



## The Dataset



(a) MNIST

**Target**



(b) SVHN

**Source**



## **Phase 1 (FY2019): Unsupervised domain adaptation for imbalanced data**

- Make target data into imbalanced condition  
(Ex. hundred for “0” against thousand for each “1” to “9”)
- Supervised learning for source data
- Unsupervised adversarial learning for source/target data
- Evaluate target data
- Improve performance as high as supervised learning for target data

## **Phase 2 (FY2020): Unsupervised domain adaptation for imbalanced small data**

- Reduce numbers of target data  
(Ex. fifty for “0” against five hundred for each “1” to “9”)
- Do the same as phase 1 described above





## Rough Plan

- Until June 2019: Phase 1 – benchmarking, extracting issues, making a plan
- In December 2019: Phase 1 – intermediate report → HQ → feedback
- In March 2020: Phase 1 – final report and outcome → HQ → feedback
  
- Until April 2020: Phase 2 – benchmarking, extracting issues, making a plan
- In September 2020: Phase 2 – intermediate report → HQ → feedback
- In December 2020: Phase 2 – pre-final report → HQ → feedback
- In March 2021: Phase 2 – final report and outcome → HQ → End

## International Conference

- Once or more per year

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