

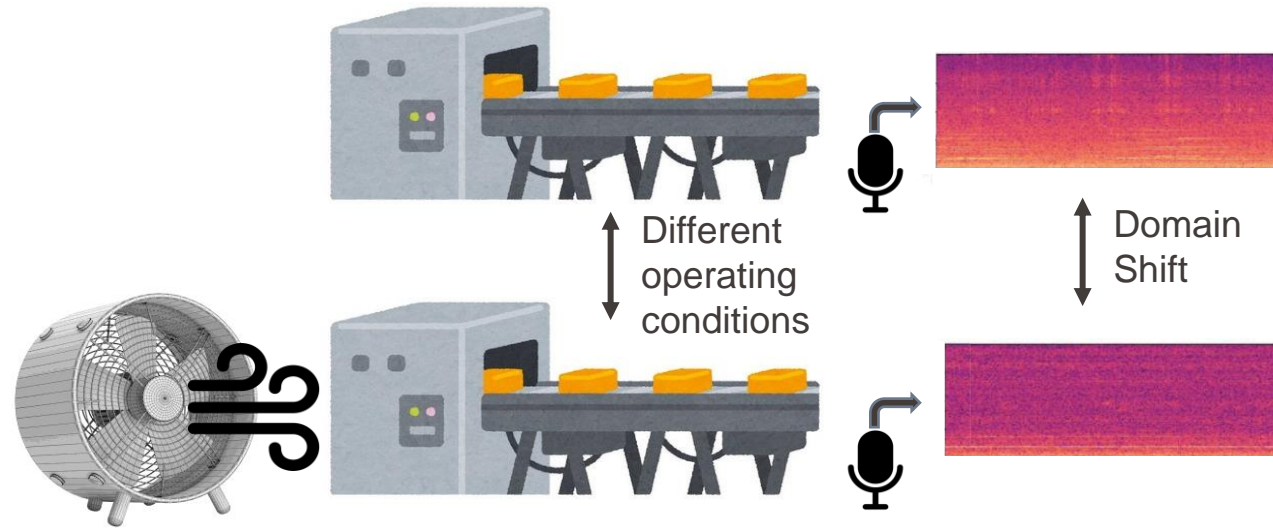
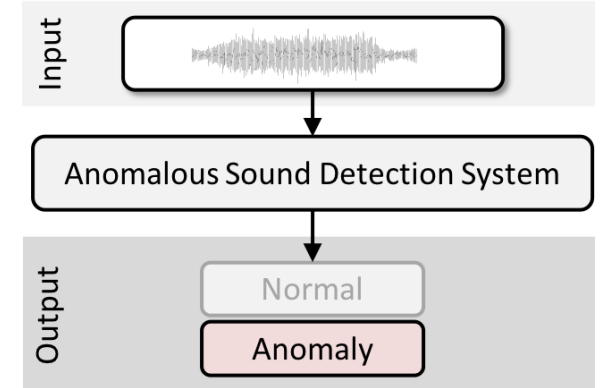
DG-MIX : Domain Generalization for Anomalous Sound Detection based on Self-Supervised Learning

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Anomalous sound detection (ASD)

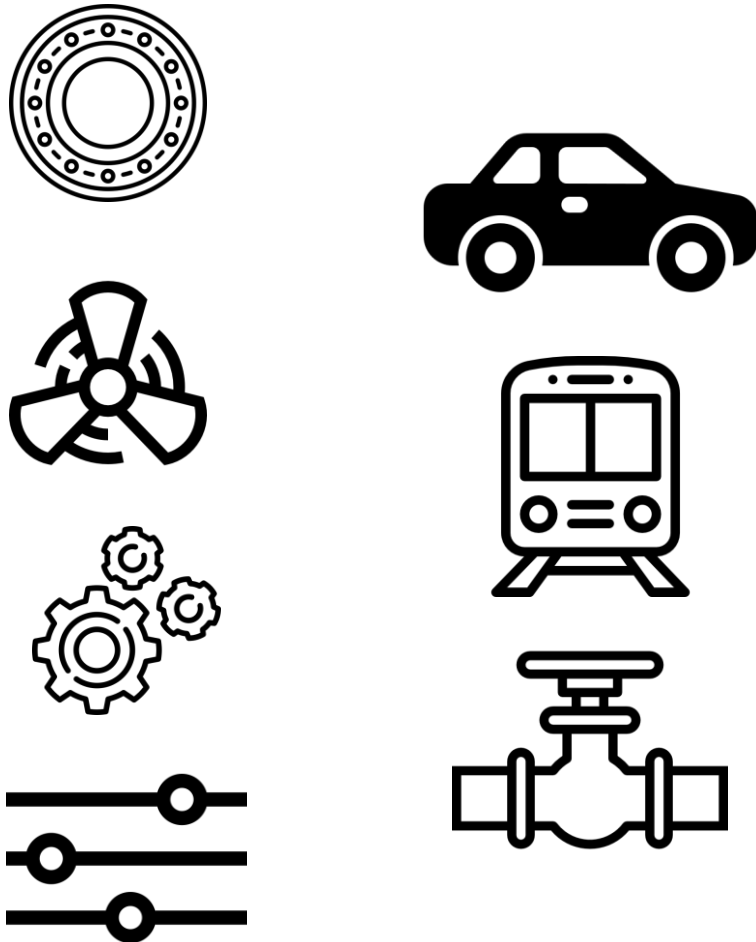
- **ASD** aims to identify whether a machine sound is:
 - Normal
 - Anomalous
- Anomalous sounds:
 - Very diverse
 - Rarely occur
- Real-world environments are often **changing**.



DCASE2022 Data Challenge Task 2

Description:

The dataset contains 7 machine types with 6 sections each:



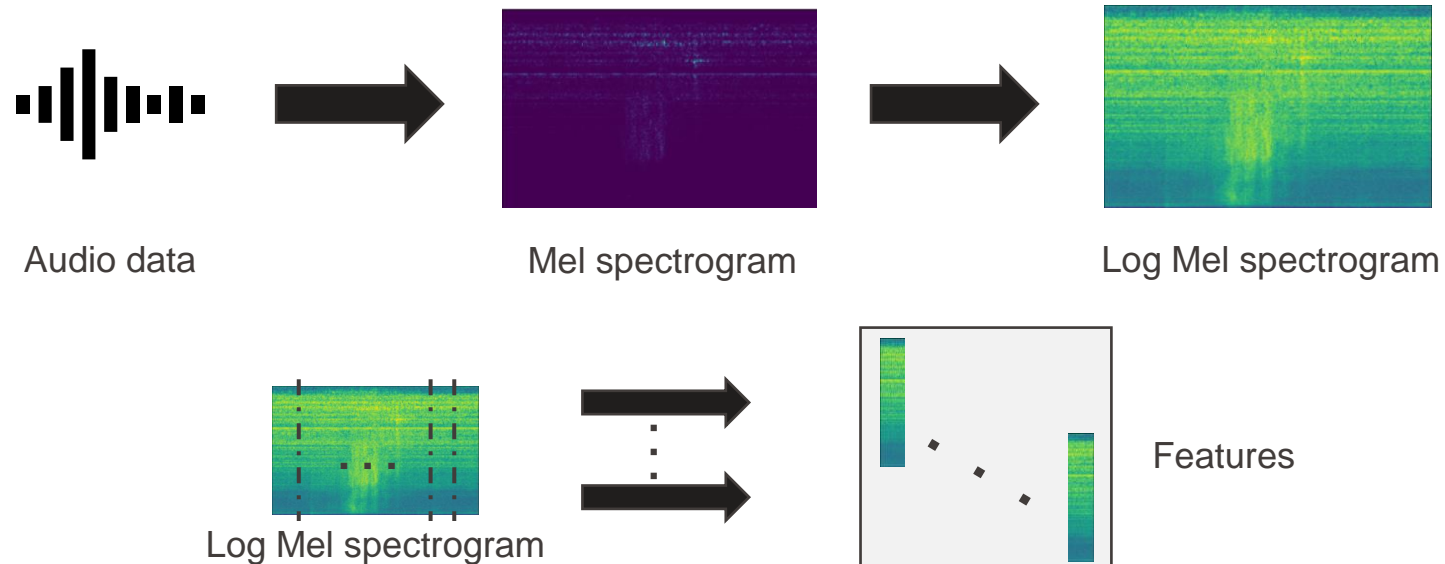
■ DG-MIX : DOMAIN GENERALIZATION FOR ANOMALOUS SOUND
DETECTION based on SELF-SUPERVISED LEARNING

Each section has
Source domain : 990 audio normal clips
Target domain : 10 audio normal clips
and is dedicated to a **specific** type of **domain shift**.

DG
operating conditions vary
(voltage, velocity, factory noise, etc ...)

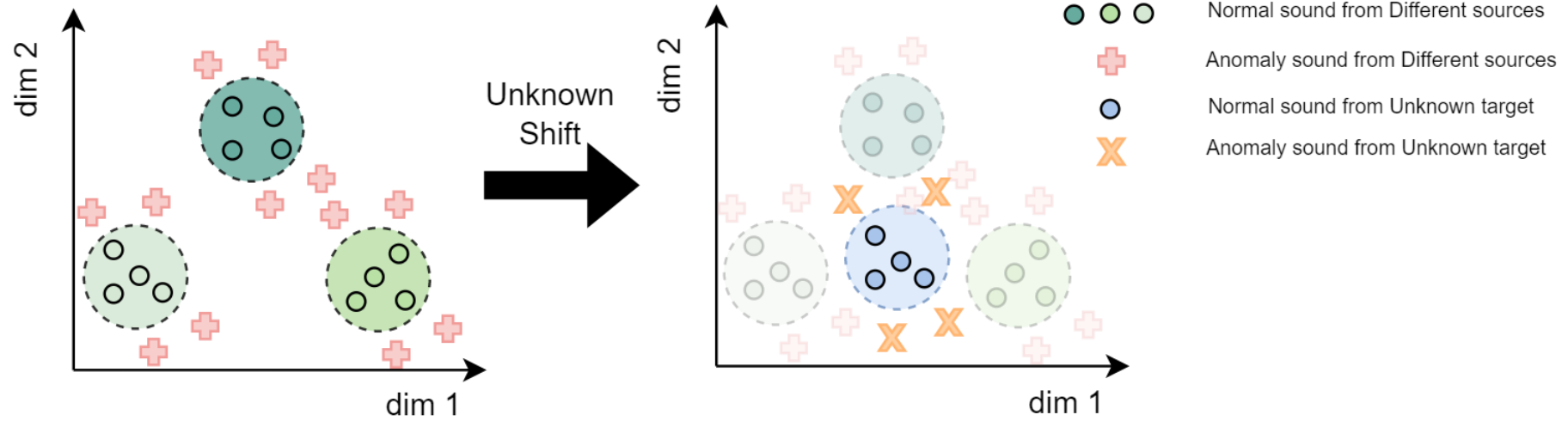
- We propose a new consistency term with:
 - **Virtual domains** generated by linearly interpolated feature vectors
 - Operating condition-invariant health-state representation

Preprocessing step:



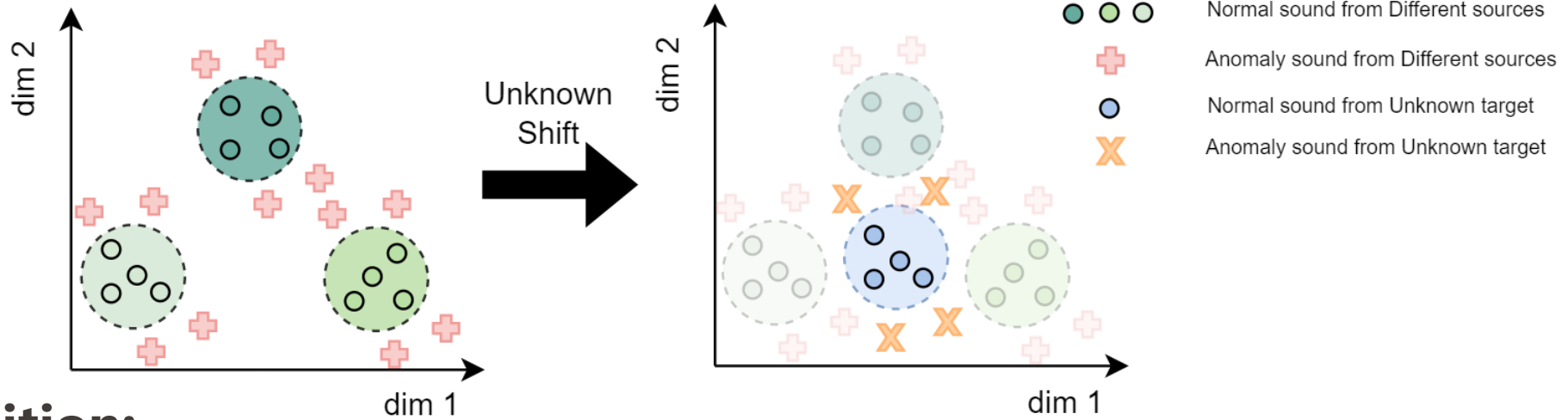
Proposed Framework : DG-Mix - Intuition

Domain Generalization:

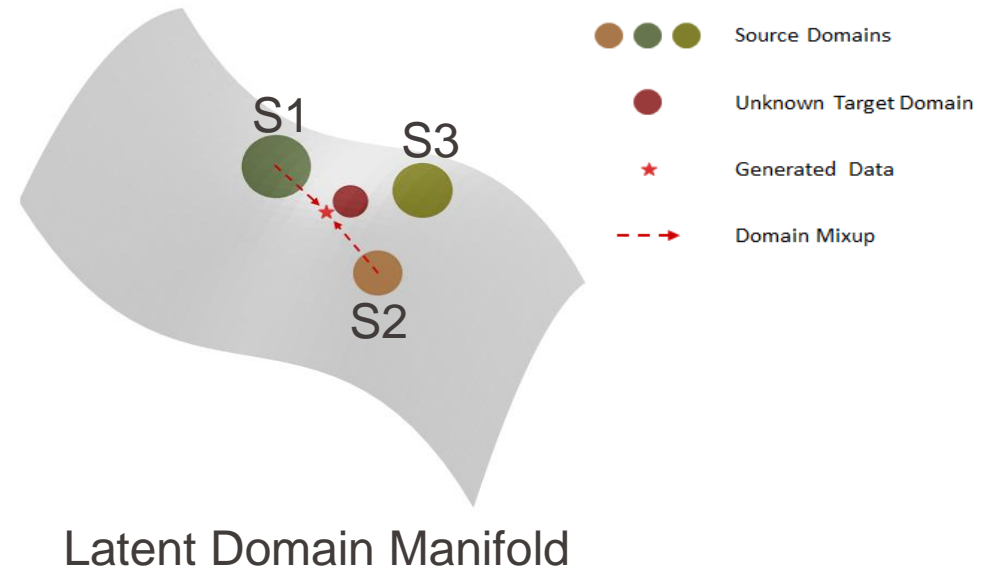
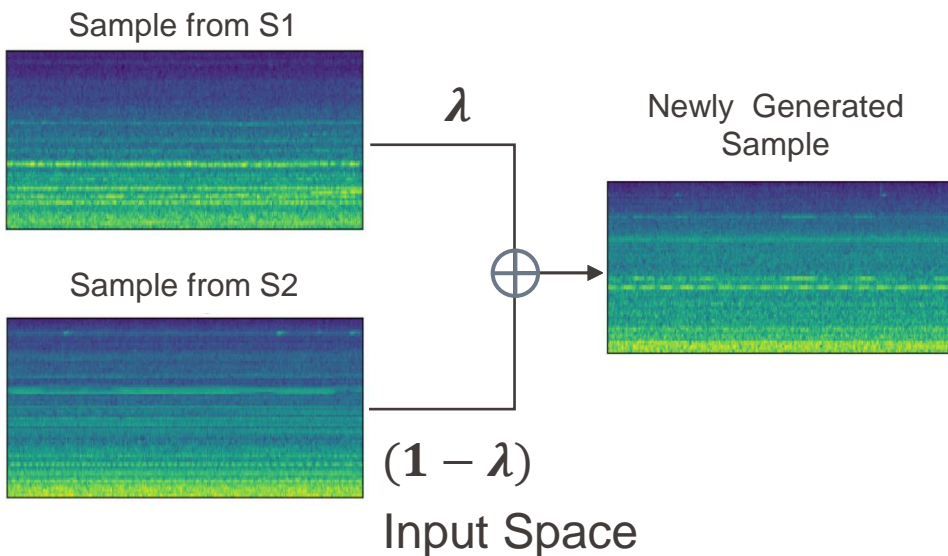


Proposed Framework : DG-Mix - Intuition

Domain Generalization:

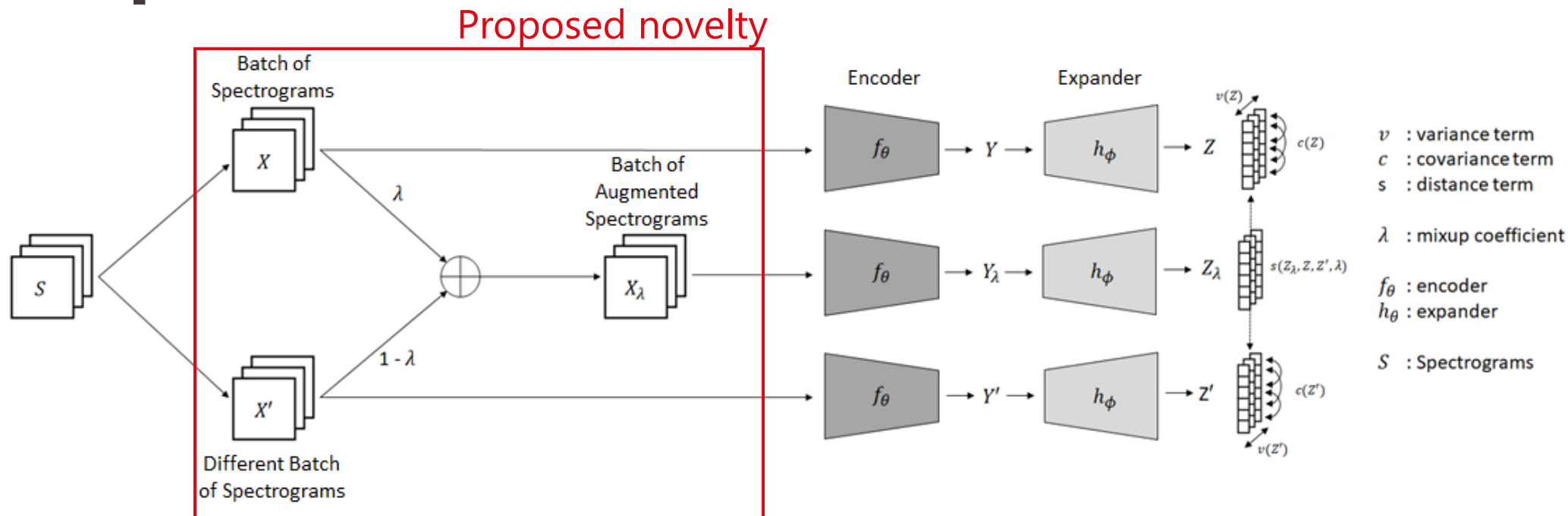


Intuition:



■ DG-MIX : DOMAIN GENERALIZATION FOR ANOMALOUS SOUND DETECTION based on SELF-SUPERVISED LEARNING

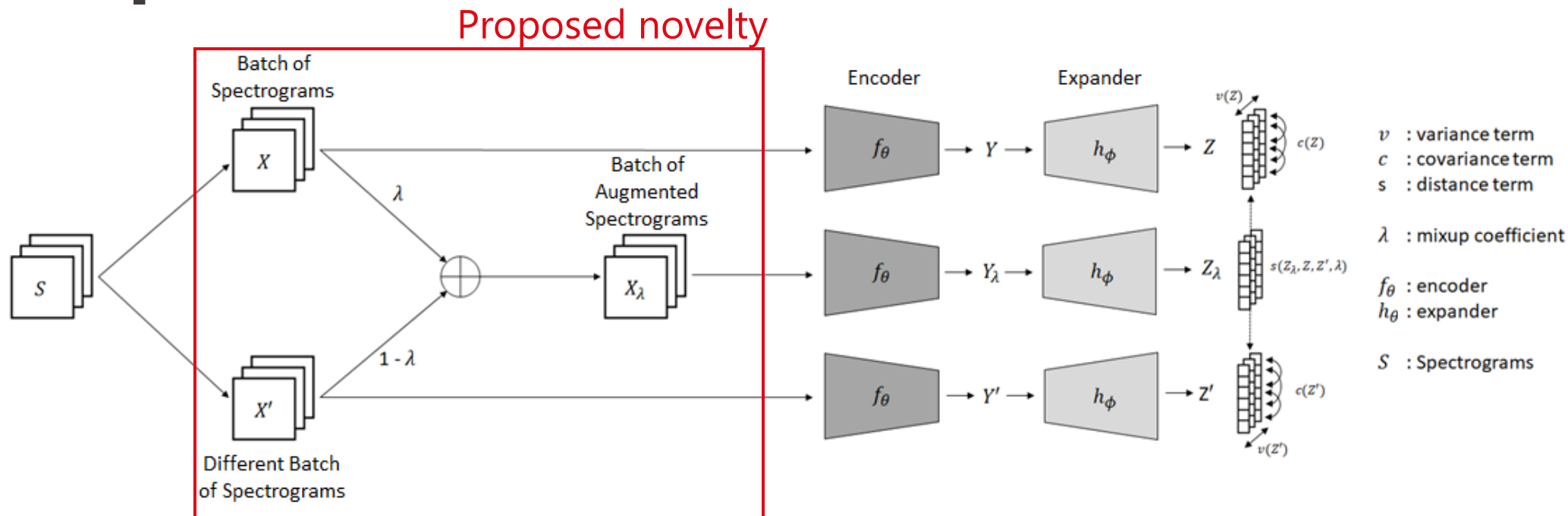
Proposed Framework : DG-Mix



DG-Mix learns **condition-invariant** representations in an **unsupervised** manner by:

- Revealing the impact of attributes on the data.
- Obtaining uncorrelated embedding features containing specific information.
- Respecting defined **geometrical constraints** between different domains.

Proposed Framework : DG-Mix - Losses

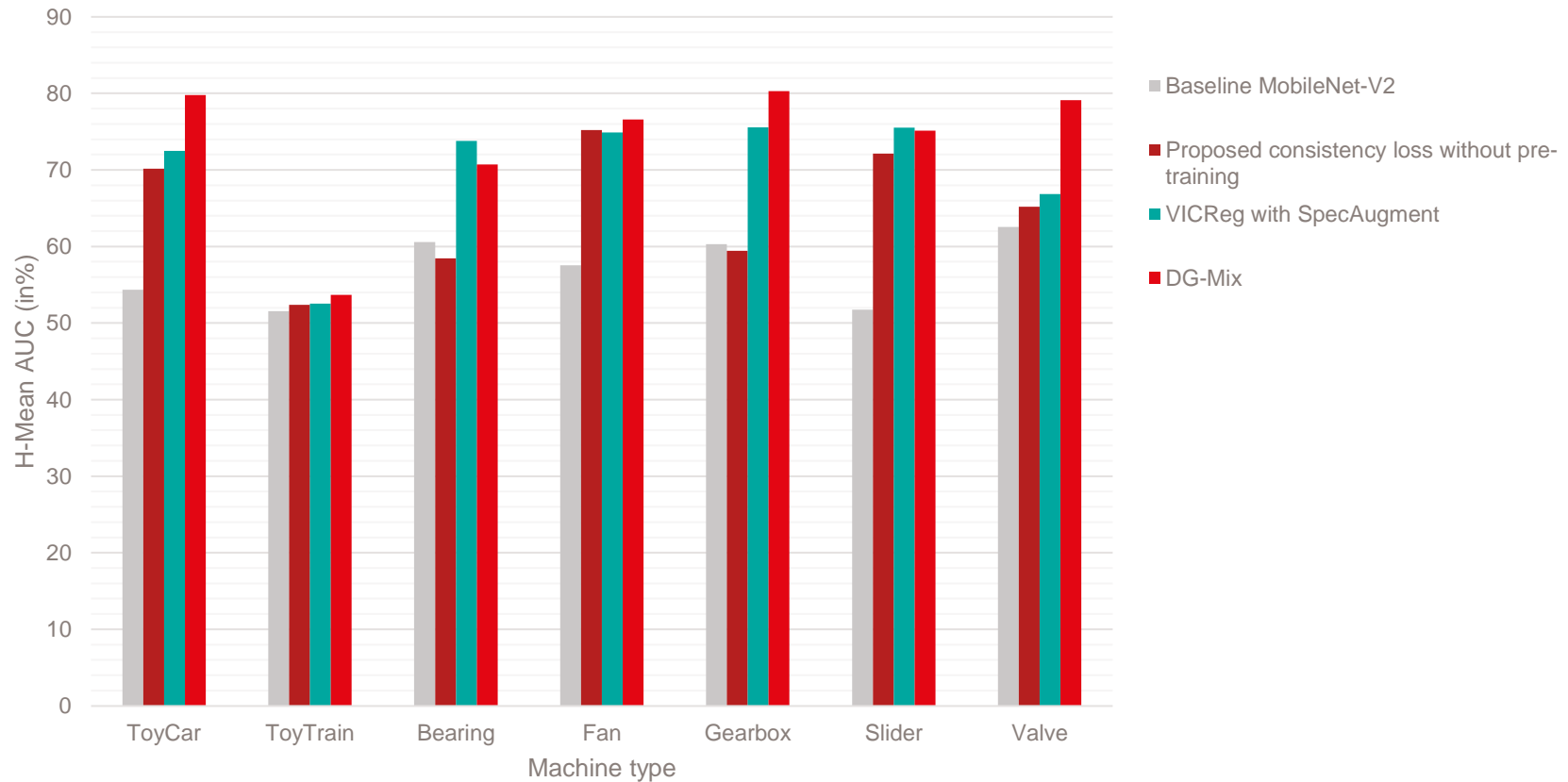


VICReg [1]

$$L_{total} = \frac{1}{N} \sum_{i=1}^N \|z_{\lambda,i} - (\lambda z_i + (1-\lambda) z'_i)\|_2^2 + \frac{1}{D} \sum_{i=1}^D \max(0, 1 - \sqrt{\text{Var}(z_i)}) + \frac{1}{d} \sum_{i \neq j} [C(Z)]_{i,j}^2$$

Results

Methods	Baseline MobileNet-V2	Proposed consistency loss without pre-training	VICReg with SpecAugment	DG-Mix
Overall Harmonic Mean (in %)	56.65	68.32	69.18	72.34



- A novel **ADS** framework for **Domain Generalization** was proposed
- **Pre-training** improves generalization of a model.
- Superior performance on evaluation dataset.
- **Mixup** :
 - Better than standard data augmentations
 - No prior knowledge of fault characteristics assumed