

loss 변경에 따른 성능 평가

- classification model 기준으로 학습 EfficientNet V2  
EfficientNet B0
- random weight (random seed 고정)
- batch 32, lr 0.0001, epoch 50 → 100 → 300
- test data : 각 클래스별 20개씩, RING은 train, test 동일하게(6개)
- loss function
  - 1) Cross Entropy Loss
  - 2) LDAM Loss
  - 3) Focal Loss

# 전체 data set 사용 - epoch 50

## Cross Entropy Loss

V2

	precision	recall	f1-score	support
BOLD	0.59	0.85	0.69	20
BUBBLE	0.90	0.90	0.90	20
BURR	0.48	0.70	0.57	20
DAMAGE	1.00	0.25	0.40	20
DOT	0.00	0.00	0.00	20
DUST	0.39	0.85	0.53	20
FOLD	0.43	0.75	0.55	20
LINE	0.64	0.45	0.53	20
REACT	0.90	0.95	0.93	20
RING	1.00	1.00	1.00	6
SCRATCH	0.71	0.60	0.65	20
TIP	1.00	0.15	0.26	20
accuracy		0.60		226
macro avg	0.67	0.62	0.58	226
weighted avg	0.65	0.60	0.56	226

V2

	precision	recall	f1-score	support
BOLD	0.43	1.00	0.61	20
BUBBLE	0.94	0.75	0.83	20
BURR	0.65	0.65	0.65	20
DAMAGE	1.00	0.15	0.26	20
DOT	0.00	0.00	0.00	20
DUST	0.36	0.70	0.47	20
FOLD	0.46	0.55	0.50	20
LINE	0.82	0.70	0.76	20
REACT	0.95	1.00	0.98	20
RING	1.00	1.00	1.00	6
SCRATCH	0.53	0.85	0.65	20
TIP	0.00	0.00	0.00	20
accuracy		0.59		226
macro avg	0.60	0.61	0.56	226
weighted avg	0.57	0.59	0.53	226

## Focal Loss

V2

	precision	recall	f1-score	support
BOLD	0.58	0.75	0.65	20
BUBBLE	0.95	0.90	0.92	20
BURR	0.42	0.55	0.48	20
DAMAGE	1.00	0.25	0.40	20
DOT	0.00	0.00	0.00	20
DUST	0.35	0.75	0.48	20
FOLD	0.38	0.75	0.51	20
LINE	0.75	0.15	0.25	20
REACT	0.95	1.00	0.98	20
RING	1.00	1.00	1.00	6
SCRATCH	0.57	0.65	0.60	20
TIP	0.64	0.35	0.45	20
accuracy		0.57		226
macro avg	0.63	0.59	0.56	226
weighted avg	0.61	0.57	0.53	226

BO  
transformNone):

	precision	recall	f1-score	support
BOLD	0.46	0.90	0.61	20
BUBBLE	0.90	0.90	0.90	20
BURR	0.48	0.70	0.57	20
DAMAGE	0.00	0.00	0.00	20
DOT	0.00	0.00	0.00	20
DUST	0.33	0.85	0.48	20
FOLD	0.21	0.20	0.21	20
LINE	0.91	0.50	0.65	20
REACT	0.95	0.95	0.95	20
RING	1.00	1.00	1.00	6
SCRATCH	0.47	0.40	0.43	20
TIP	0.50	0.10	0.17	20
accuracy		0.51		226
macro avg	0.52	0.54	0.50	226
weighted avg	0.49	0.51	0.47	226

Bo

	precision	recall	f1-score	support
BOLD	0.57	0.80	0.67	20
BUBBLE	0.73	0.95	0.83	20
BURR	0.64	0.45	0.53	20
DAMAGE	1.00	0.20	0.33	20
DOT	0.00	0.00	0.00	20
DUST	0.33	0.70	0.45	20
FOLD	0.36	0.50	0.42	20
LINE	0.52	0.55	0.54	20
REACT	1.00	0.80	0.89	20
RING	1.00	1.00	1.00	6
SCRATCH	0.46	0.80	0.58	20
TIP	0.33	0.05	0.09	20
accuracy		0.54		226
macro avg	0.58	0.57	0.53	226
weighted avg	0.55	0.54	0.50	226

Bo

	precision	recall	f1-score	support
BOLD	0.55	0.80	0.65	20
BUBBLE	0.95	0.90	0.92	20
BURR	0.74	0.70	0.72	20
DAMAGE	0.44	0.20	0.28	20
DOT	0.00	0.00	0.00	20
DUST	0.36	0.80	0.50	20
FOLD	0.43	0.60	0.50	20
LINE	0.78	0.70	0.74	20
REACT	1.00	0.95	0.97	20
RING	1.00	1.00	1.00	6
SCRATCH	0.58	0.75	0.65	20
TIP	0.33	0.10	0.15	20
accuracy		0.68		226
macro avg	0.60	0.62	0.59	226
weighted avg	0.57	0.60	0.57	226

전체 data 사용 - epoch 50 + image augmentation (상하반전, 좌우반전)

### Cross Entropy Loss

V2	precision	recall	f1-score	support
BOLD	0.61	0.95	0.75	20
BUBBLE	0.90	0.95	0.93	20
BURR	0.38	0.50	0.43	20
DAMAGE	0.83	0.50	0.62	20
DOT	0.00	0.00	0.00	20
DUST	0.39	0.75	0.52	20
FOLD	0.58	0.90	0.71	20
LINE	0.80	0.20	0.32	20
REACT	0.95	1.00	0.98	20
RING	1.00	1.00	1.00	6
SCRATCH	0.74	0.85	0.79	20
TIP	0.22	0.10	0.14	20
accuracy		0.62		226
macro avg	0.62	0.64	0.60	226
weighted avg	0.60	0.62	0.57	226

### LDAM Loss

V2	precision	recall	f1-score	support
BOLD	0.00	0.00	0.00	20
BUBBLE	0.00	0.00	0.00	20
BURR	0.00	0.00	0.00	20
DAMAGE	0.00	0.00	0.00	20
DOT	0.00	0.00	0.00	20
DUST	0.09	1.00	0.16	20
FOLD	0.00	0.00	0.00	20
LINE	0.00	0.00	0.00	20
REACT	0.00	0.00	0.00	20
RING	0.00	0.00	0.00	6
SCRATCH	0.00	0.00	0.00	20
TIP	0.00	0.00	0.00	20
accuracy		?	0.09	226
macro avg	0.01	0.08	0.01	226
weighted avg	0.01	0.09	0.01	226

### Focal Loss

V2	precision	recall	f1-score	support
BOLD	0.59	0.95	0.73	20
BUBBLE	0.86	0.90	0.88	20
BURR	0.50	0.30	0.38	20
DAMAGE	1.00	0.20	0.33	20
DOT	0.25	0.05	0.08	20
DUST	0.39	0.80	0.52	20
FOLD	0.59	0.85	0.69	20
LINE	0.52	0.75	0.61	20
REACT	0.95	1.00	0.98	20
RING	1.00	1.00	1.00	6
SCRATCH	0.62	0.65	0.63	20
TIP	0.33	0.10	0.15	20
accuracy		0.61		226
macro avg	0.63	0.63	0.58	226
weighted avg	0.61	0.61	0.56	226

### BO

BO	precision	recall	f1-score	support
BOLD	0.52	0.80	0.63	20
BUBBLE	0.89	0.85	0.87	20
BURR	0.43	0.45	0.44	20
DAMAGE	0.67	0.20	0.31	20
DOT	0.00	0.00	0.00	20
DUST	0.34	0.80	0.48	20
FOLD	0.45	0.65	0.53	20
LINE	0.65	0.55	0.59	20
REACT	1.00	1.00	1.00	20
RING	1.00	1.00	1.00	6
SCRATCH	0.65	0.75	0.70	20
TIP	0.25	0.05	0.08	20
accuracy		0.57		226
macro avg	0.57	0.59	0.55	226
weighted avg	0.54	0.57	0.52	226

### BO

BO	precision	recall	f1-score	support
BOLD	0.53	0.90	0.67	20
BUBBLE	0.90	0.90	0.90	20
BURR	0.38	0.55	0.45	20
DAMAGE	0.50	0.10	0.17	20
DOT	0.00	0.00	0.00	20
DUST	0.38	0.60	0.46	20
FOLD	0.44	0.40	0.42	20
LINE	0.57	0.60	0.59	20
REACT	0.83	0.95	0.88	20
RING	1.00	1.00	1.00	6
SCRATCH	0.55	0.90	0.68	20
TIP	0.25	0.05	0.08	20
accuracy		0.55		226
macro avg	0.53	0.58	0.52	226
weighted avg	0.50	0.55	0.50	226

### BO

BO	precision	recall	f1-score	support
BOLD	0.53	0.90	0.67	20
BUBBLE	0.90	0.95	0.93	20
BURR	0.58	0.70	0.64	20
DAMAGE	0.67	0.10	0.17	20
DOT	0.00	0.00	0.00	20
DUST	0.37	0.70	0.48	20
FOLD	0.52	0.65	0.58	20
LINE	0.81	0.65	0.72	20
REACT	0.91	1.00	0.95	20
RING	1.00	1.00	1.00	6
SCRATCH	0.53	0.85	0.65	20
TIP	0.50	0.05	0.09	20
accuracy		0.61		226
macro avg	0.61	0.63	0.57	226
weighted avg	0.59	0.61	0.55	226

# KILL data set - epoch 100

## Cross Entropy Loss

V2	precision	recall	f1-score	support
BOLD	0.75	0.90	0.82	20
BUBBLE	0.95	0.90	0.92	20
BURR	0.50	0.60	0.55	20
DAMAGE	1.00	0.15	0.26	20
DOT	0.00	0.00	0.00	20
DUST	0.30	0.65	0.41	20
FOLD	0.44	0.85	0.58	20
LINE	0.85	0.55	0.67	20
REACT	0.95	1.00	0.98	20
RING	1.00	1.00	1.00	6
SCRATCH	0.52	0.60	0.56	20
TIP	0.25	0.10	0.14	20
accuracy			0.58	226
macro avg	0.63	0.61	0.57	226
weighted avg	0.60	0.58	0.55	226

## LDAM Loss

sv2 model(inputs)	precision	recall	f1-score	support
iteration BOLD puts, 0.58	0.75	0.65	20	
ward() BUBBLE	0.95	0.90	0.92	20
.step() BURR	0.48	0.55	0.51	20
DAMAGE	0.67	0.10	0.17	20
DOT	0.00	0.00	0.00	20
DUST	0.28	0.75	0.41	20
FOLD	0.33	0.60	0.43	20
LINE	0.86	0.30	0.44	20
REACT	0.74	1.00	0.85	20
RING	1.00	1.00	1.00	6
SCRATCH	0.59	0.50	0.54	20
TIP	0.17	0.05	0.08	20
running_loss / len(train_loader.dataset)				
upper_accuracy		0.51	226	
(epoch macro avg) / (epoch 0.55), Loss 0.54 (epoch 0.50 loss):		0.50	226	
weighted avg	0.53	0.51	0.47	226

## Focal Loss

V2	precision	recall	f1-score	support
BOLD	0.62	0.90	0.73	20
BUBBLE	0.95	0.90	0.92	20
BURR	0.57	0.60	0.59	20
DAMAGE	0.75	0.15	0.25	20
DOT	0.00	0.00	0.00	20
DUST	0.35	0.70	0.47	20
FOLD	0.37	0.70	0.48	20
LINE	0.75	0.60	0.67	20
REACT	0.87	1.00	0.93	20
RING	1.00	1.00	1.00	6
SCRATCH	0.70	0.80	0.74	20
TIP	0.50	0.10	0.17	20
accuracy		0.60	226	
macro avg	0.62	0.62	0.58	226
weighted avg	0.59	0.60	0.55	226

B0	precision	recall	f1-score	support
BOLD	0.41	0.60	0.49	20
BUBBLE	0.95	0.95	0.95	20
BURR	0.55	0.60	0.57	20
DAMAGE	1.00	0.05	0.10	20
DOT	0.00	0.00	0.00	20
DUST	0.31	0.70	0.43	20
FOLD	0.29	0.45	0.35	20
LINE	0.68	0.65	0.67	20
REACT	0.90	0.95	0.93	20
RING	1.00	1.00	1.00	6
SCRATCH	0.40	0.50	0.44	20
TIP	0.25	0.05	0.08	20
accuracy		0.51	226	
macro avg	0.56	0.54	0.50	226
weighted avg	0.54	0.51	0.47	226

B0	precision	recall	f1-score	support
BOLD	0.37	0.80	0.51	20
BUBBLE	0.90	0.90	0.90	20
BURR	0.73	0.40	0.52	20
DAMAGE	0.00	0.00	0.00	20
DOT	0.00	0.00	0.00	20
DUST	0.32	0.60	0.42	20
FOLD	0.43	0.30	0.35	20
LINE	0.64	0.70	0.67	20
REACT	0.76	0.95	0.84	20
RING	1.00	1.00	1.00	6
SCRATCH	0.42	0.70	0.53	20
TIP	0.27	0.15	0.19	20
accuracy		0.51	226	
macro avg	0.49	0.54	0.49	226
weighted avg	0.46	0.51	0.46	226

B0	precision	recall	f1-score	support
BOLD	0.47	0.85	0.61	20
BUBBLE	0.82	0.90	0.86	20
BURR	0.58	0.70	0.64	20
DAMAGE	0.50	0.10	0.17	20
DOT	0.00	0.00	0.00	20
DUST	0.32	0.75	0.45	20
FOLD	0.38	0.45	0.41	20
LINE	0.79	0.55	0.65	20
REACT	1.00	0.95	0.97	20
RING	1.00	0.50	0.67	6
SCRATCH	0.57	0.60	0.59	20
TIP	0.67	0.30	0.41	20
accuracy		0.56	226	
macro avg	0.59	0.55	0.53	226
weighted avg	0.57	0.56	0.53	226