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Fusing Metadata and Dermoscopy Images for Skin Disease Diagnosis

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Motivations

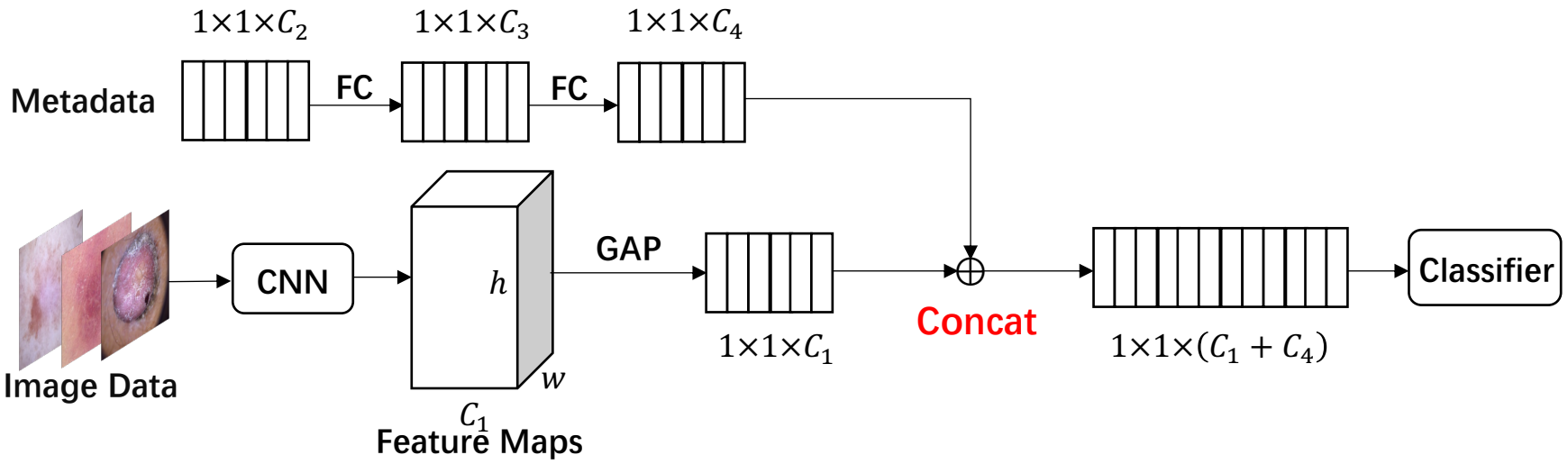
- Dermatologists use  to diagnose.

Gender Age Location

- Skin diseases' classification needs to be improved.

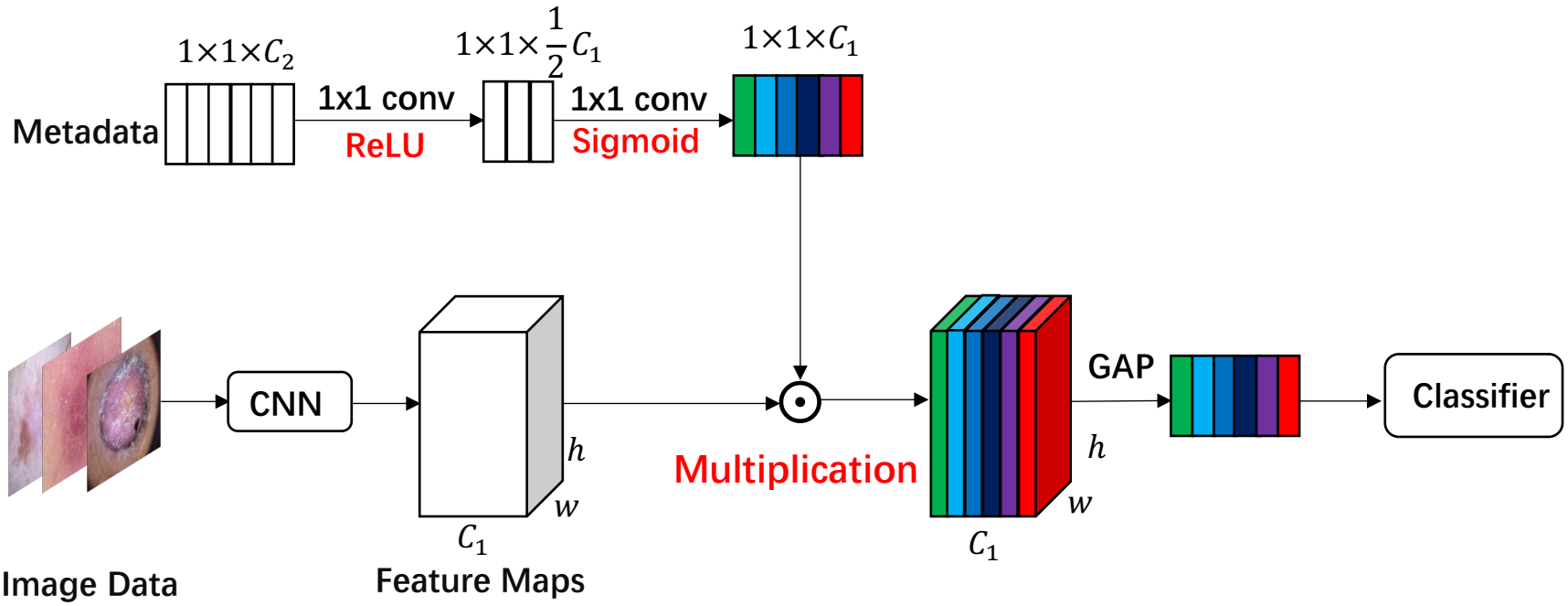
Why not use patient information to improve performance?

Baseline Concatenation-based Model



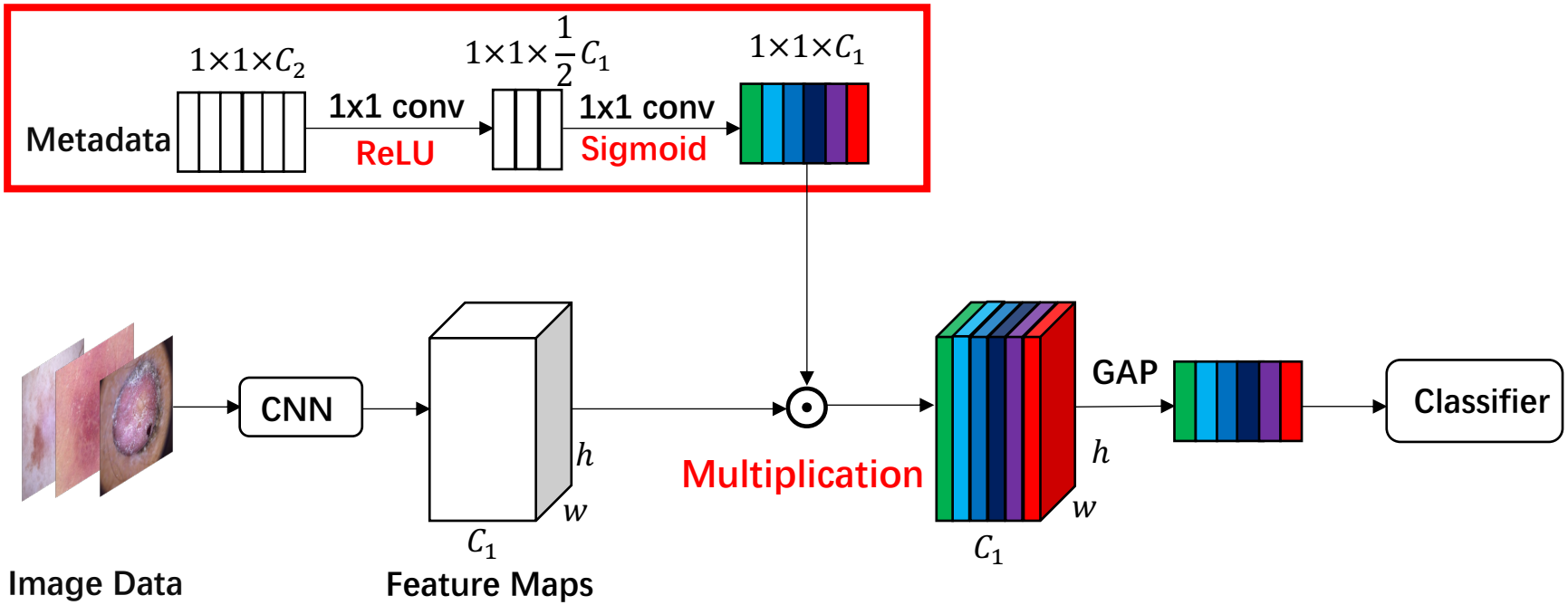
Metadata interacts with visual features indirectly

Our Multiplication-based Model



Metadata interacts with visual features directly

Our Multiplication-based Model



Metadata interacts with visual features directly

Work better with metadata !
Work well with different backbone!

Backbones	No metadata	Concatenation-based	Ours
AlexNet	74.68 ± 0.92	76.55 ± 1.25	**78.26** ± 1.55
VGG19	81.60 ± 1.67	82.35 ± 1.68	**84.06** ± 1.16
ResNet50	82.50 ± 1.31	82.98 ± 1.35	**84.02** ± 1.50
DenseNet161	84.59 ± 1.42	85.85 ± 0.92	**87.03** ± 1.40
SENet154	85.44 ± 1.09	86.46 ± 0.69	**87.64** ± 0.52
PNASNet-5	87.90 ± 1.32	87.25 ± 0.73	**89.09** ± 0.67

ISIC2018 Dataset with Mean Class Recall

Work well on rare disease categories!

Diseases	Baseline	Fusion-network	Meta-network
NV (6705)	95.31 ± 1.35	**95.38**±1.68	93.42 ± 1.19
MEL (1113)	**84.24**±0.79	76.54 ± 1.25	78.26 ± 0.73
BKL (1098)	81.31 ± 0.45	84.47 ± 0.69	**85.64**±1.03
BCC (514)	90.58 ± 1.25	91.99 ± 1.35	**92.02**±1.38
AKIEC (327)	**83.45** ±1.23	80.84 ± 0.92	80.23±1.20
VASC (143)	99.23 ± 0.86	99.22 ± 0.73	**99.36**±0.67
DF (115)	63.56 ± 1.32	76.78 ± 0.73	**84.55**±0.47

Rare diseases

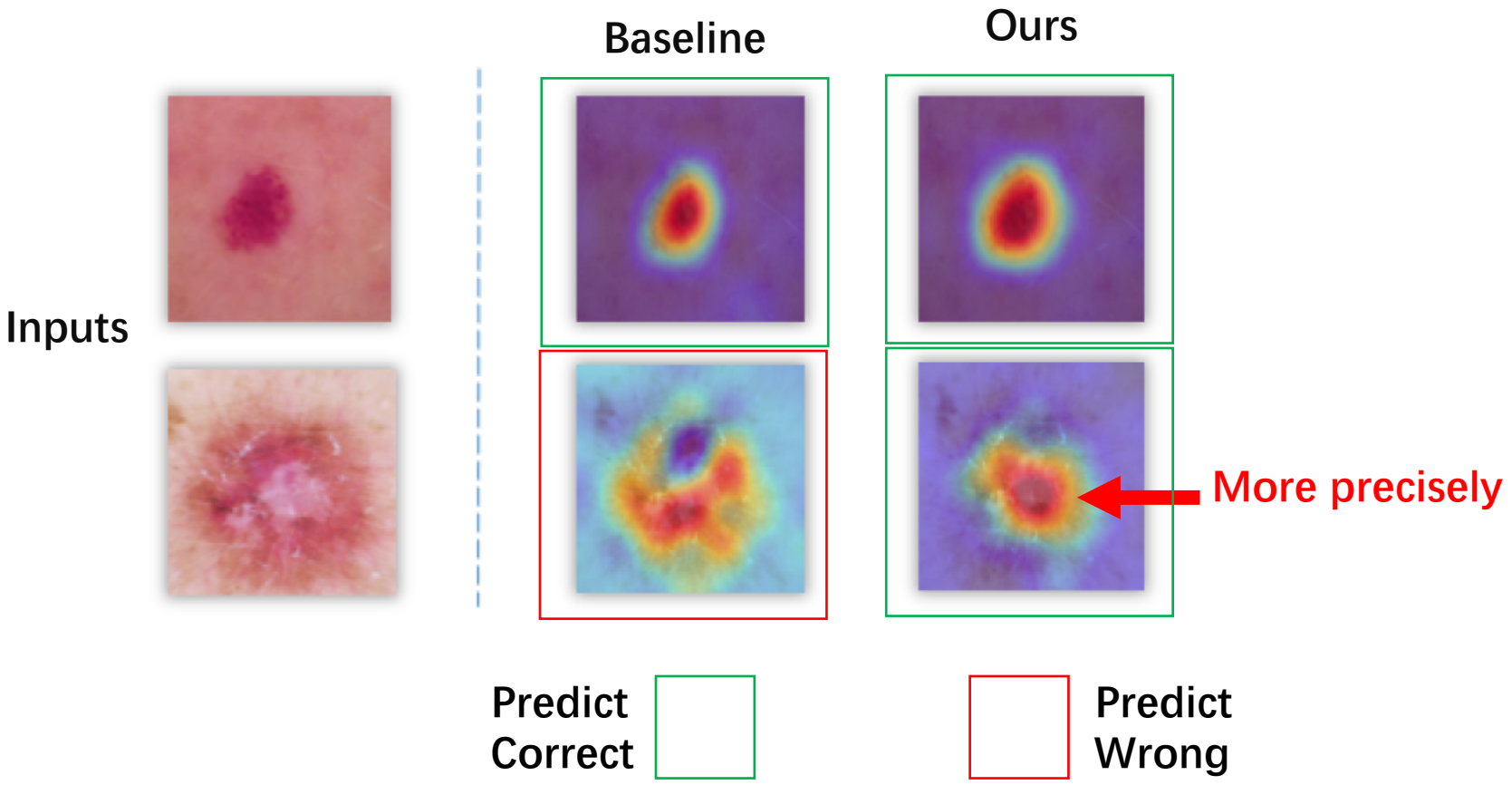
Age and localization are more important!

Age	-	✓	-	-	✓	-	✓	✓
Gender	-	-	✓	-	✓	✓	-	✓
Localization	-	-	-	✓	-	✓	✓	✓
MCR	85.44 (1.09)	85.84 (0.85)	84.04 (0.05)	87.06 (0.20)	84.16 (0.71)	85.91 (0.58)	87.70 (0.99)	87.64 (0.52)

The worst result, with only gender

The best result, without gender

Model has more precise attention area with metadata



Conclusions

- Metadata improves classification performance
- A novel multiplication-based method
- Improve rare diseases' performance
- Age and locaation is more important

Thank you!