Positional Normalization (PONO)

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Deep Features (in a given layer)
Deep Features (in a given layer)
Deep Features (in a given layer)
Deep Features (in a given layer)

Input images

\( m^{th} \text{ Layer} \)

Features

Batch

Fish

Mona Lisa

Flatten

Height & Width

Channels
Deep Features (in a given layer)

Input images

$m^{th}$ Layer

Features

Batch

Flatten

Height & Width

“Feature Block”

Channels

Batch

Channels
Normalization

\[ X \in \mathbb{R}^{B \times C \times H \times W} \]

\[ X_{new} = \frac{X - \mu}{\sigma} \]
Normalization

\[ X \in \mathbb{R}^{B \times C \times H \times W} \]

\[ X_{new} = (X - \mu) / \sigma \]
Normalization Variants

Batch Norm
(Ioffe & Szegedy, ICML 2015)

H: Height
W: Width

C: Channel
B: Batch

Mean / Std:

Subtracting the mean and dividing by the standard deviation (std)
Normalization Variants

Batch Norm
(Ioffe & Szegedy, ICML 2015)

Instance Norm
(Ulyanov et al., arXiv 2016)

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Group Norm  
(Wu & He, ECCV 2018)

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- **Group Norm** (Wu & He, ECCV 2018)
- **Layer Norm** (Ba et al., NeurIPS 2016)
- **Positional Norm**

Normalization Variants:

- **Mean / Std:** Subtracting the mean and dividing by the standard deviation (std)
Positional Normalization (PONO)

\[ X \in \mathbb{R}^{B \times C \times H \times W} \]

Moments:

\[
\mu_{b,h,w} = \frac{1}{C} \sum_{c=1}^{C} X_{b,c,h,w}
\]

\[
\sigma_{b,h,w} = \sqrt{\frac{1}{C} \sum_{c=1}^{C} (X_{b,c,h,w} - \mu_{b,h,w})^2}
\]
Moments in PONO

Early layer → Deeper Layer

μ

σ

μ

σ
Moments = Trash?
Moments ≠ Trash

Moment Shortcut (MS)

Moment Shortcut (MS) + PONO = PONO-MS
Image Translation

Without PONO-MS

Dataset Source: https://github.com/HsinYingLee/DRIT  Model Source: https://github.com/NVlabs/MUNIT
Image Translation

Without PONO-MS

Dataset Source: https://github.com/HsinYingLee/DRIT  Model Source: https://github.com/NVlabs/MUNIT
Image Translation

With PONO-MS

Dataset Source: https://github.com/HsinYingLee/DRIT  Model Source: https://github.com/NVlabs/MUNIT
Come to our poster for more details!

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