DTU

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Niðurkvörðun á vindi með djúpnámi

Super resolution

- Hærri upplausn í myndefni
- Djúpnám skilað góðum árangri
- Líkja má við niðurkvörðun á hnattrænt reiknuðu veðri
- Aflræn niðurkvörðun reiknifrek

"*Can SR based deep learning be considered a reliable technique for mesoscale wind field downscaling in the purpose of wind resource assessment?*"

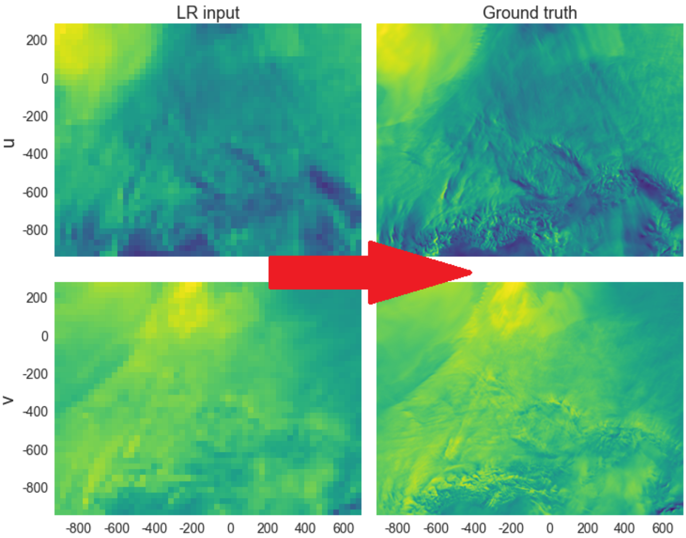

Figure 1: SR example

Þjálfunarferlið

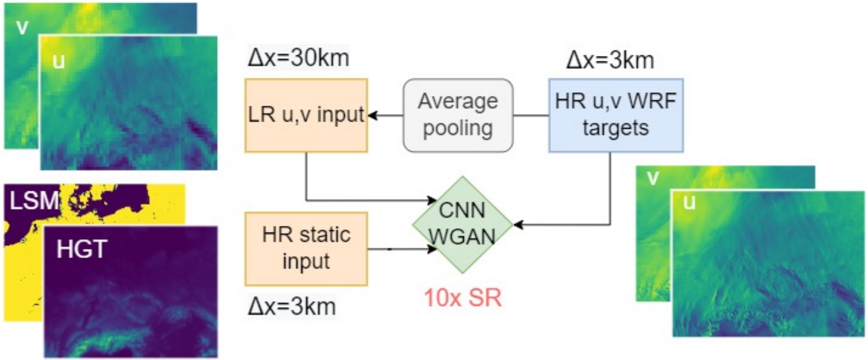

Figure 2: Illustration of the training approach and data fields from NEWA.

Földunarnet (CNNs)

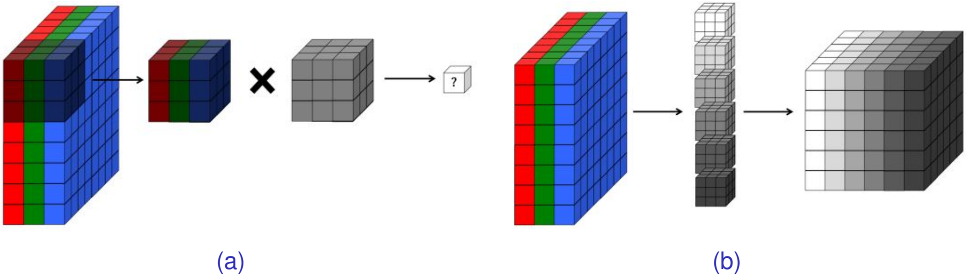

Figure 3: (a) Application of a volumetric 2D convolutional filter to a full-color RGB image and (b) a 3D visualization of a convolutional layer (Buduma and Locascio, 2017).

$$m_{ij} = f\left((\mathbf{w} * \mathbf{x})_{ij} + b\right)$$

Skapandi andstöðunet (GANs)

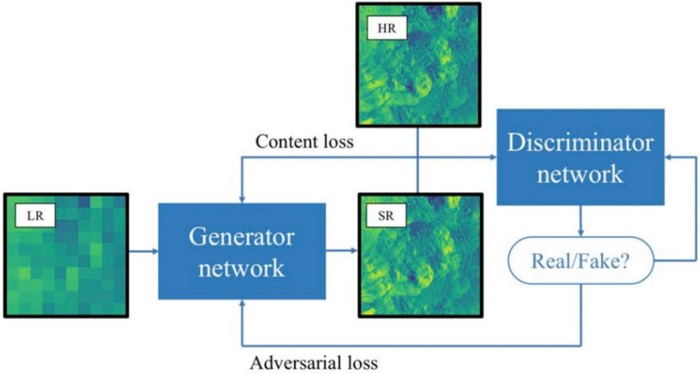

Figure 4: Schematic of SRGAN (Stengel et al., 2020)

NEWA reiknisvæði

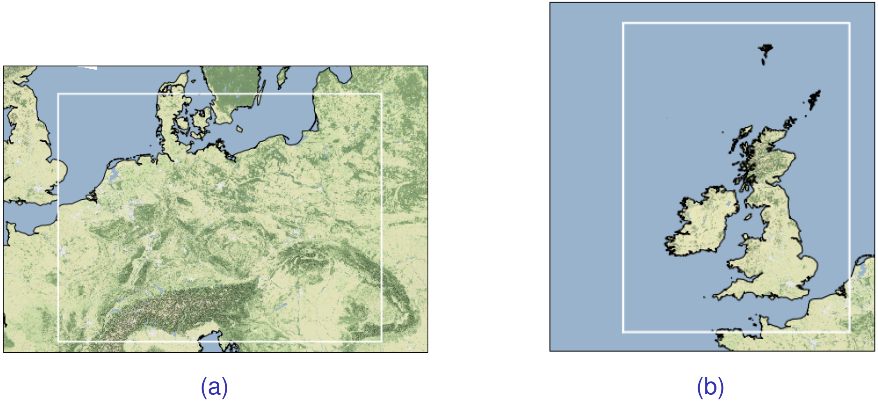

Figure 5: (a) The Central Europe (CE) and (b) the Great Britain (GB) NEWA model domains.

Niðurstöður

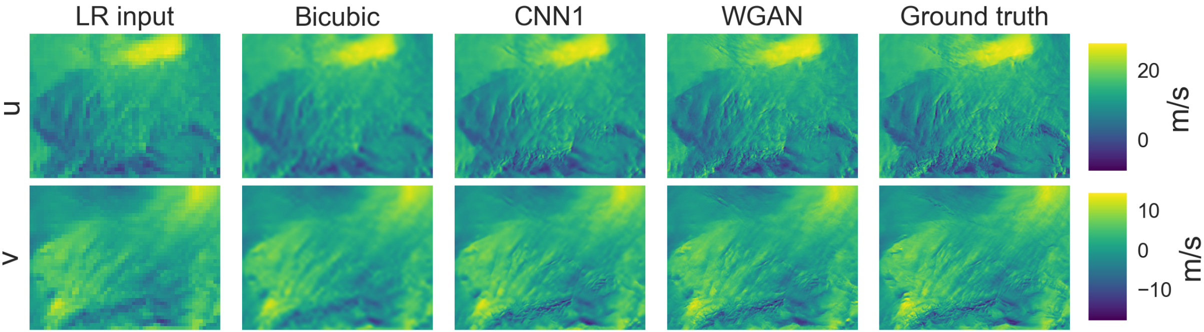

Figure 6: Comparison of various SR methods on NEWA CE domain data fields.

Domain averaged MSE

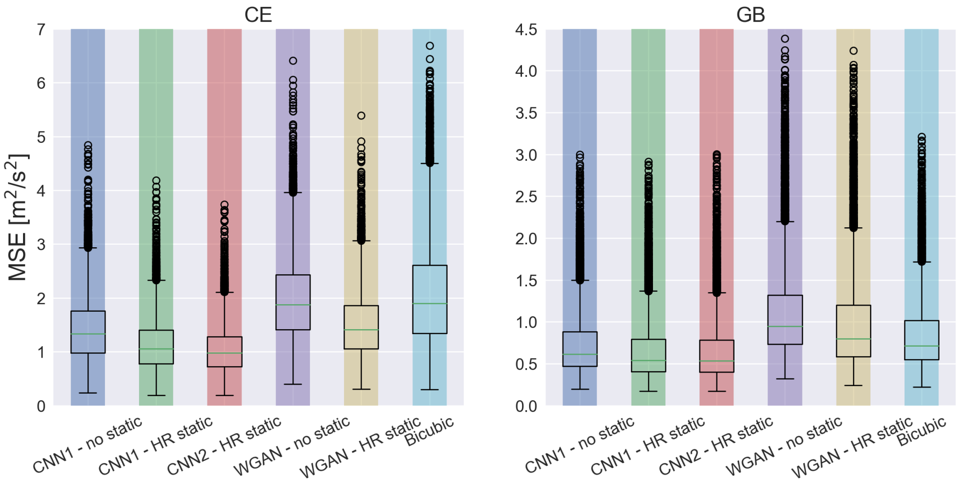

Figure 7: Statistics of spatially averaged MSE on the test set

Spatial distribution of systematic reconstruction errors

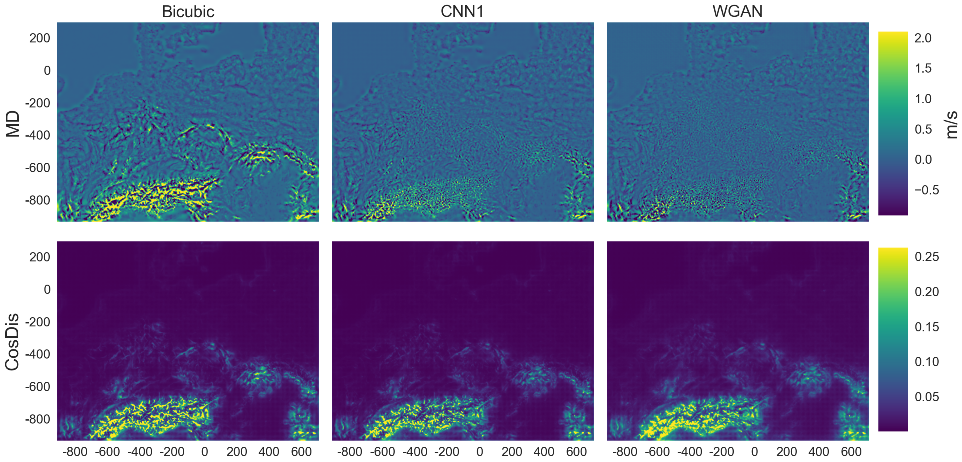

Figure 8: Mean magnitude difference (top row) and mean cosine deviations (bottom row) on the CE domain

Spatial distribution of systematic reconstruction errors

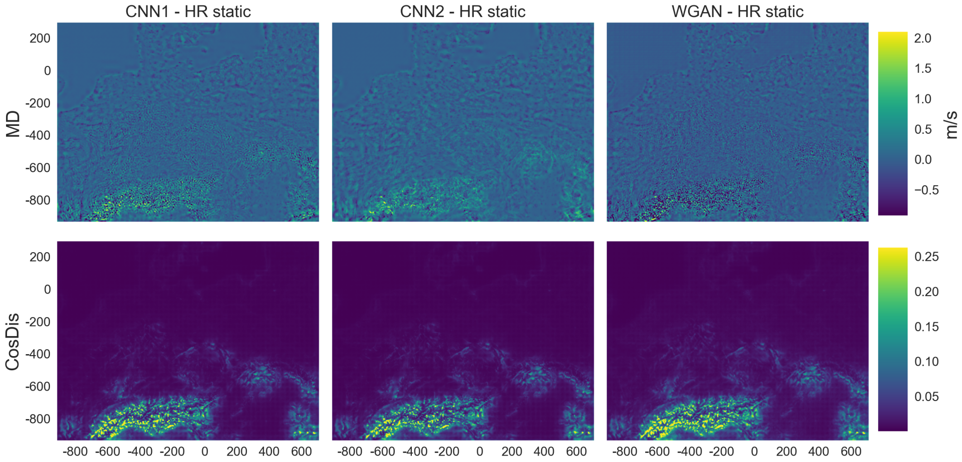

Figure 9: Mean magnitude difference (top row) and mean cosine deviations (bottom row) on the CE domain

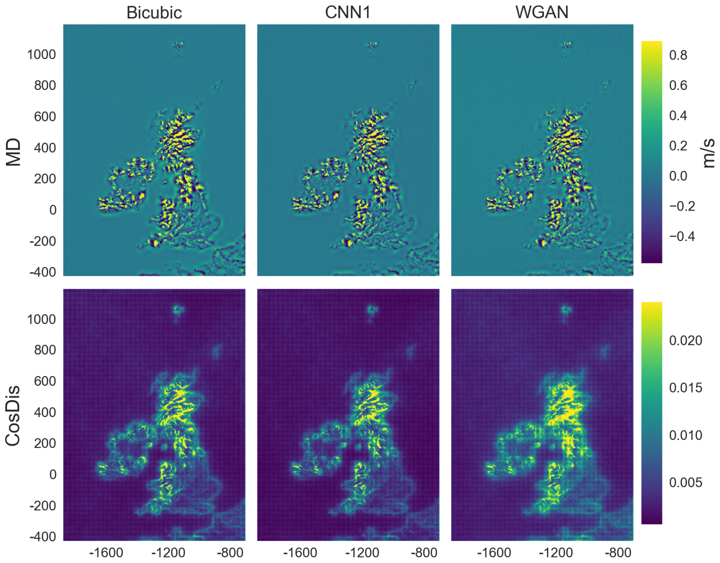

Figure 10: Mean magnitude difference (top row) and mean cosine deviations (bottom row) on the GB domain

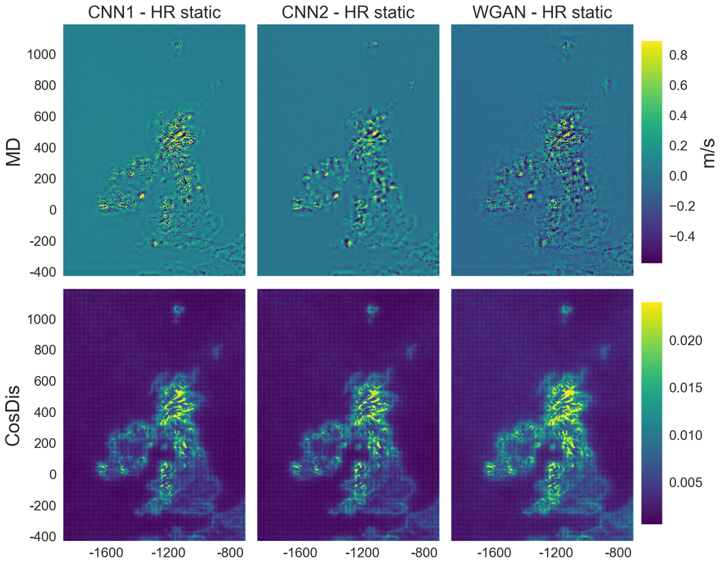

Figure 11: Mean magnitude difference (top row) and mean cosine deviations (bottom row) on the GB domain

Rófgreining

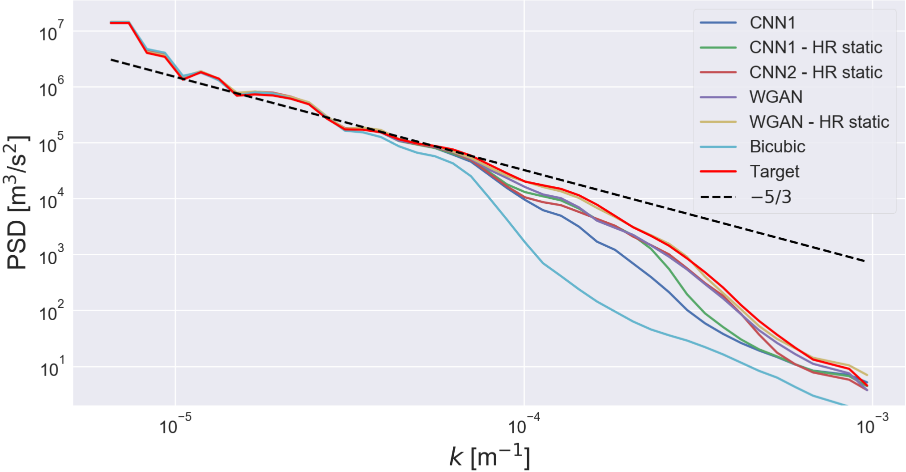

Figure 12: Radially averaged 2D spectrum

Outlook

- Notkun og prófun á fleiri NEWA reiknisvæðum
- Skoða tímaás (þróun vinds í tíma)
  - Recurrent neural networks
- WRF "parent-domain" sem lágupplausnar inntak
- Graph Neural Networks
- Safnspár til að meta óvissu

References I

- Buduma, Nikhil and Nicholas Locascio (2017). *Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms*. 1st. O'Reilly Media, Inc. ISBN: 1491925612.
- Stengel, Karen et al. (July 2020). "Adversarial super-resolution of climatological wind and solar data". In: *Proceedings of the National Academy of Sciences* 117.29, pp. 16805–16815. ISSN: 0027-8424. DOI: 10.1073/PNAS.1918964117. URL: https://www.pnas.org/content/117/29/16805.

Supporting Material - Evaluation metrics

- $\text{MSE} = \left\langle \left\| \vec{t} - \vec{y} \right\|^2 \right\rangle_{Dom}$
- $\text{CosDis} = \frac{1}{2}\left(1 - \left\langle \cos\left(\vec{t}_i, \vec{y}_i\right)\right\rangle\right) = \frac{1}{2}\left(1 - \left\langle \frac{\vec{t}_i \cdot \vec{y}_i}{\|\vec{t}_i\| \|\vec{y}_i\|} \right\rangle\right)$
- $\text{MD} = \left\langle \|\vec{t}_i\| - \|\vec{y}_i\| \right\rangle$
- $S(k) = \frac{\Delta x}{2\pi N} |X(k)|^2$

Generator network extension to ingest HR static data