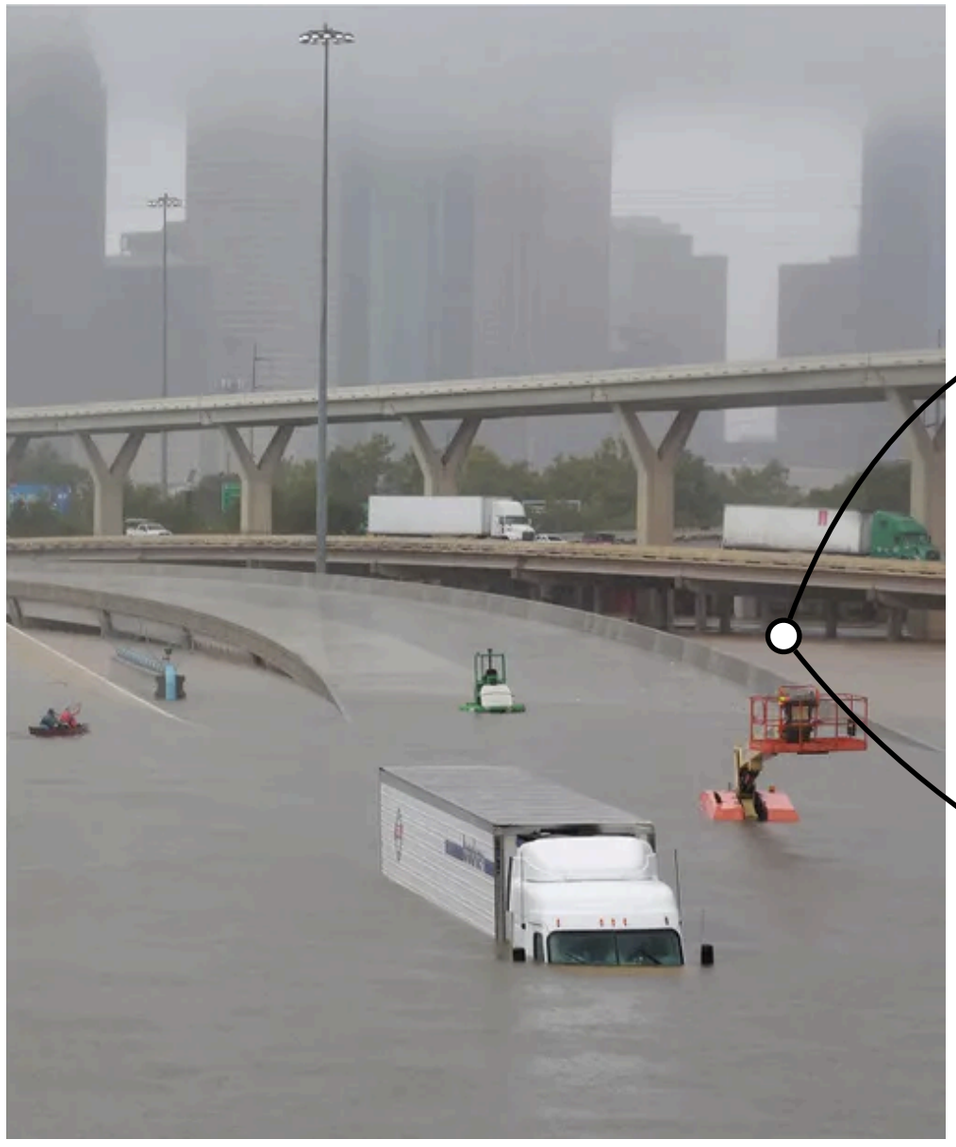
Multi-output neural processes

Zinzan Gurney

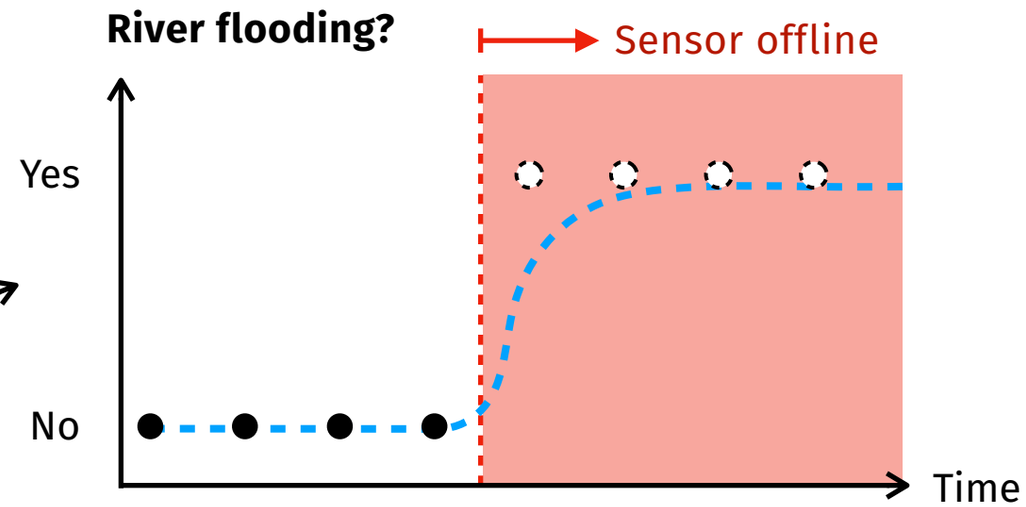
Supervised by Prof. Richard Turner

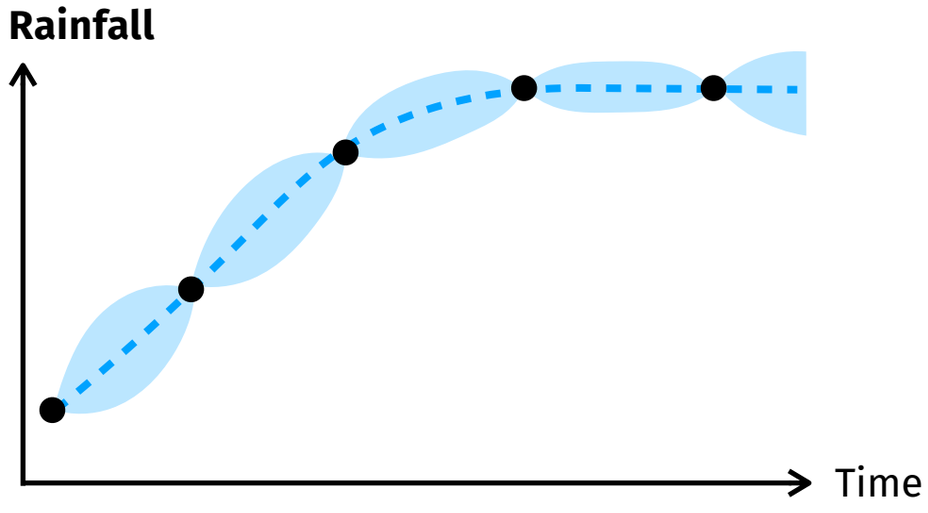
24 November 2021

What problem are we addressing?



[1]





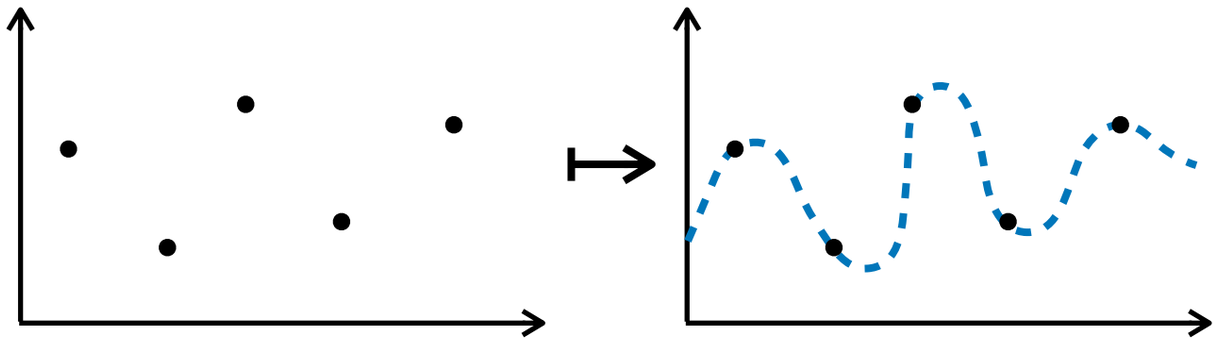
Can we make joint predictions over multiple outputs where data is missing with uncertainty?

Multi-output neural processes

What are neural processes?

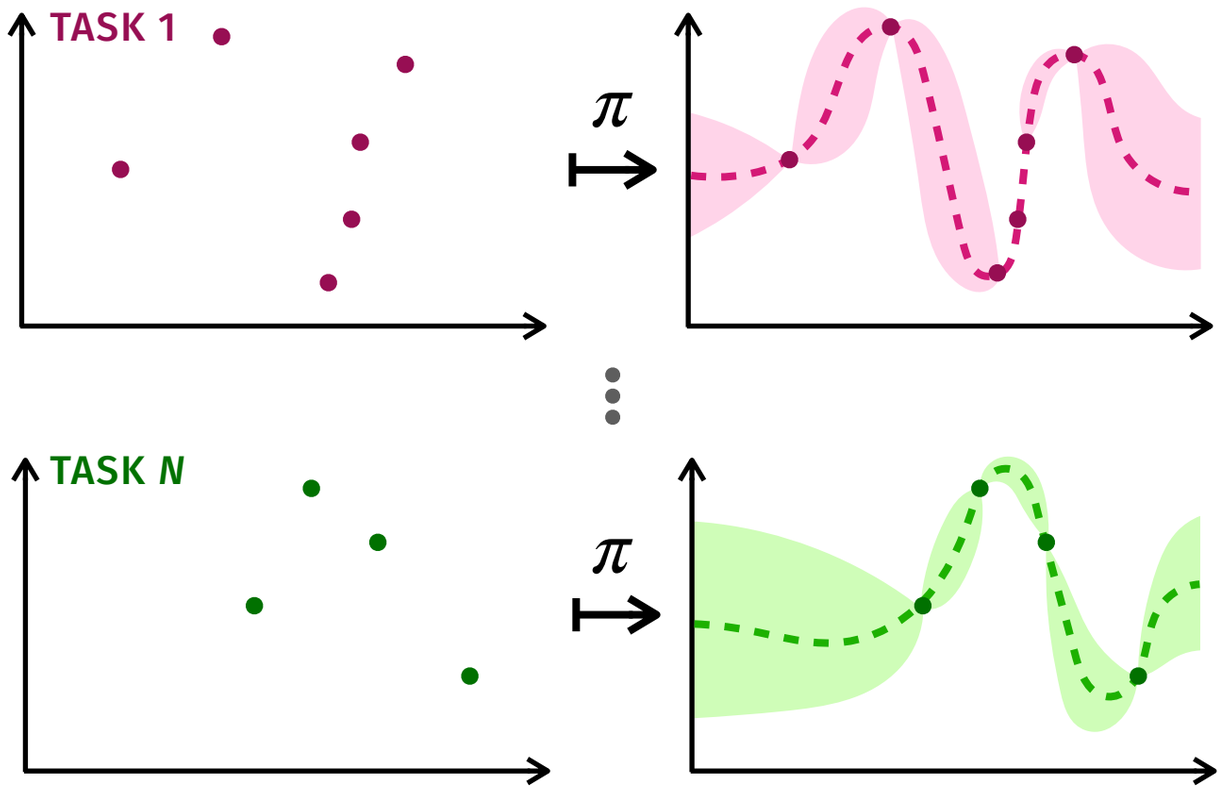
Traditional supervised learning

Dataset $\mathscr{D}$ $\longmapsto$ Prediction $f(x)$



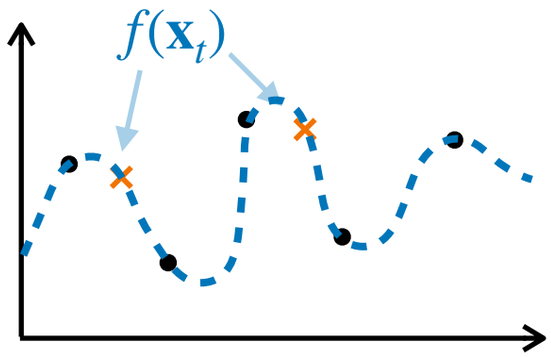
Neural processes

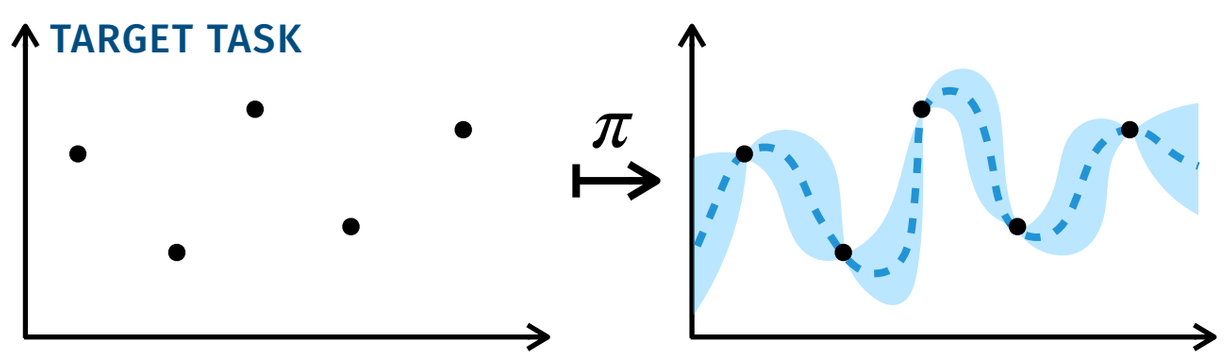
Dataset $\mathscr{D}$ $\overset{\pi}{\longmapsto}$ Prediction $p(\mathbf{y}_t \mid \mathbf{x}_t; \mathscr{D})$



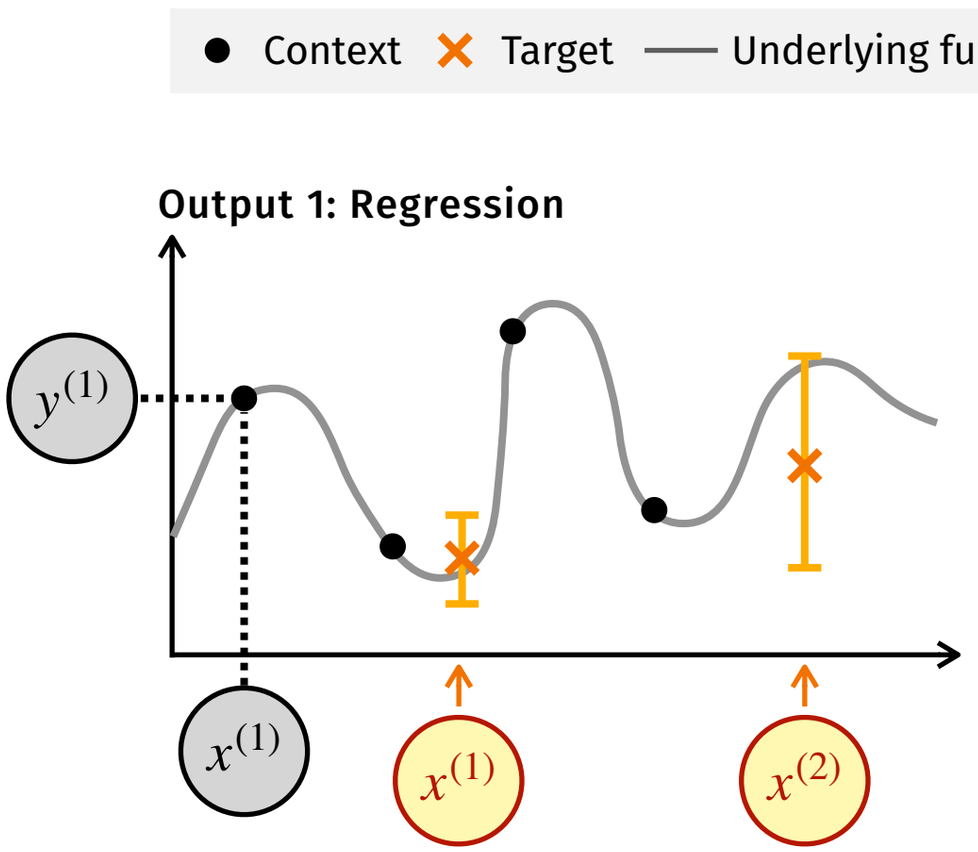
Training

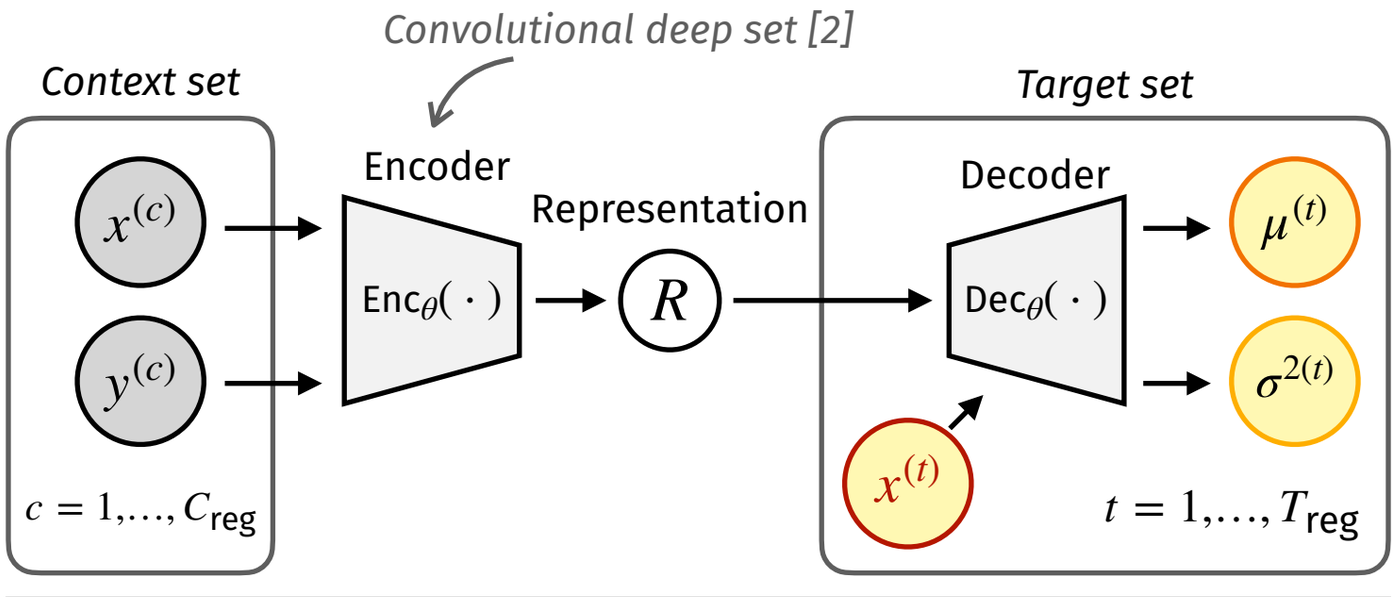
Test



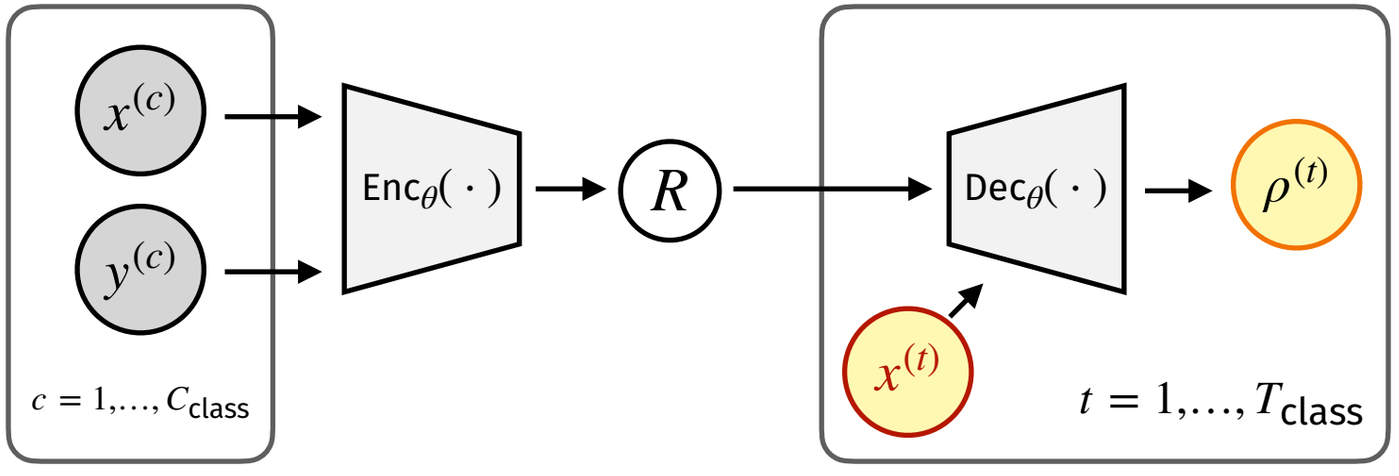


How do neural processes work?



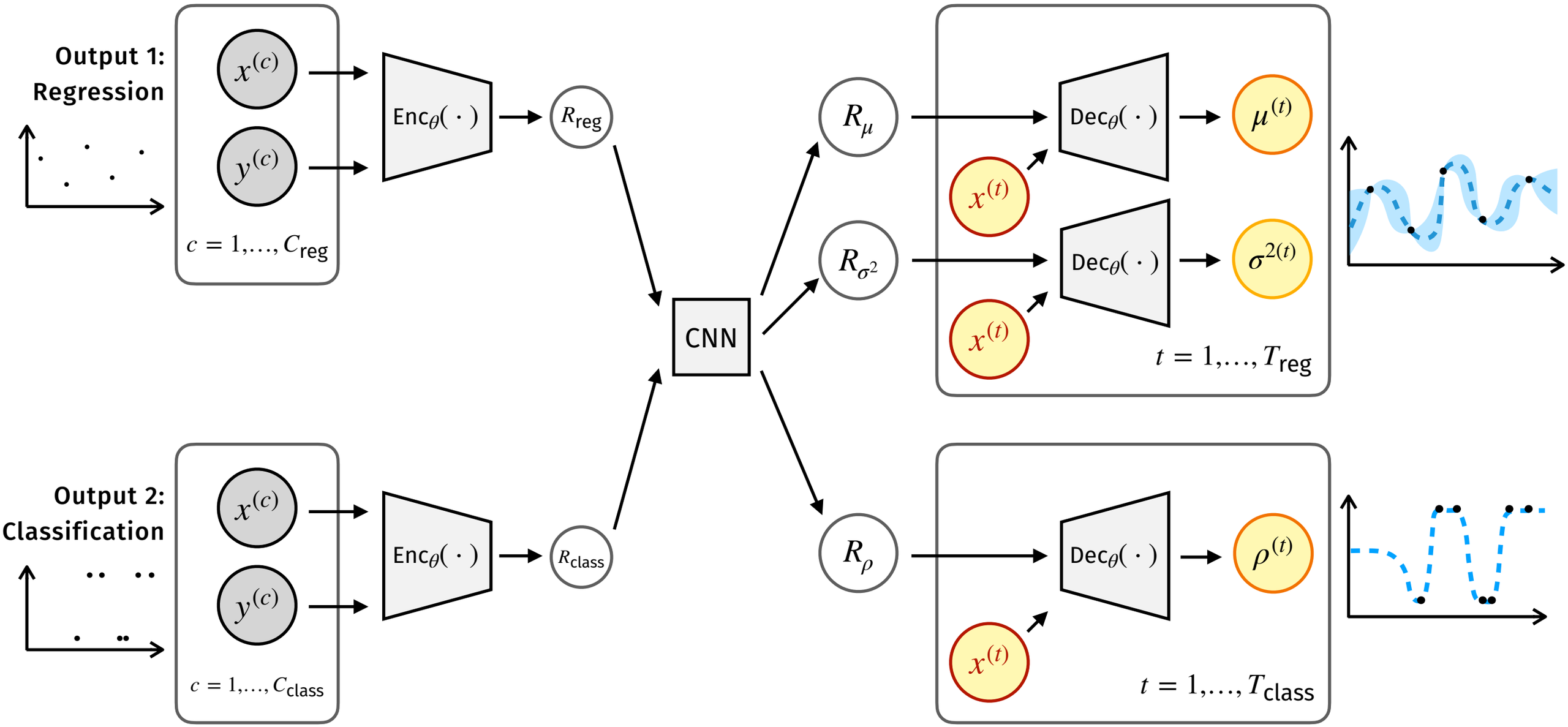


How can we connect these architectures so that our predictions are informed by both outputs?



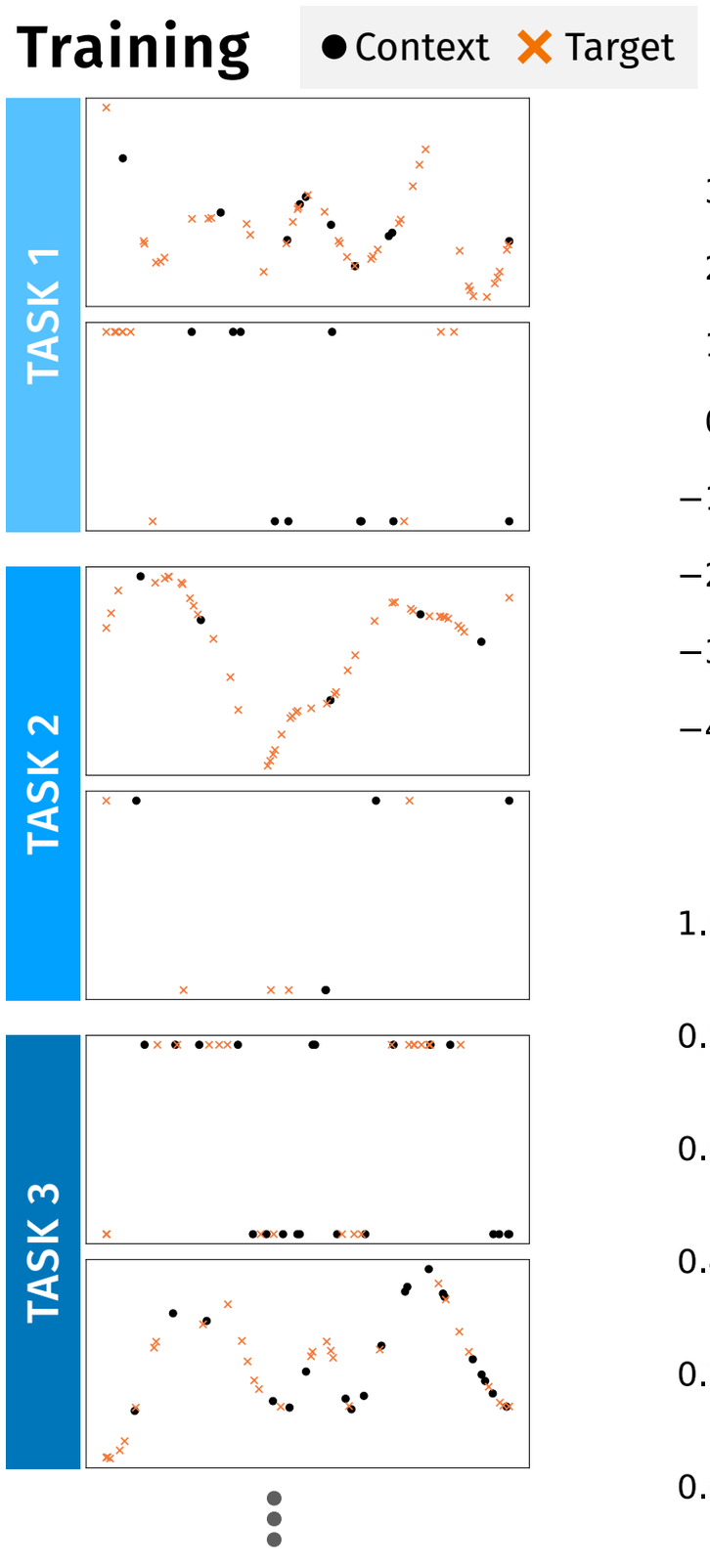
How can they handle multi-output data?

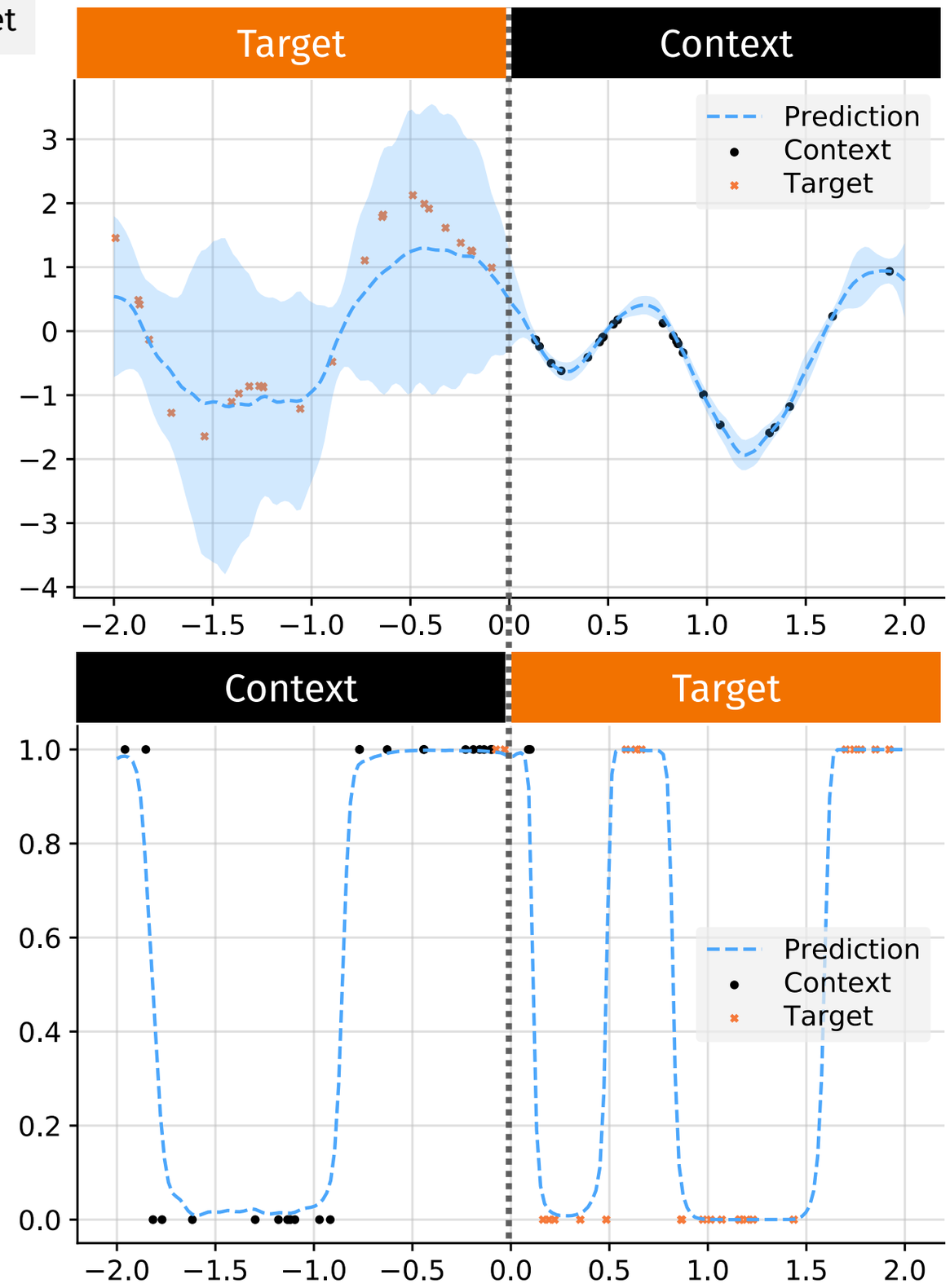
Dual-output architecture



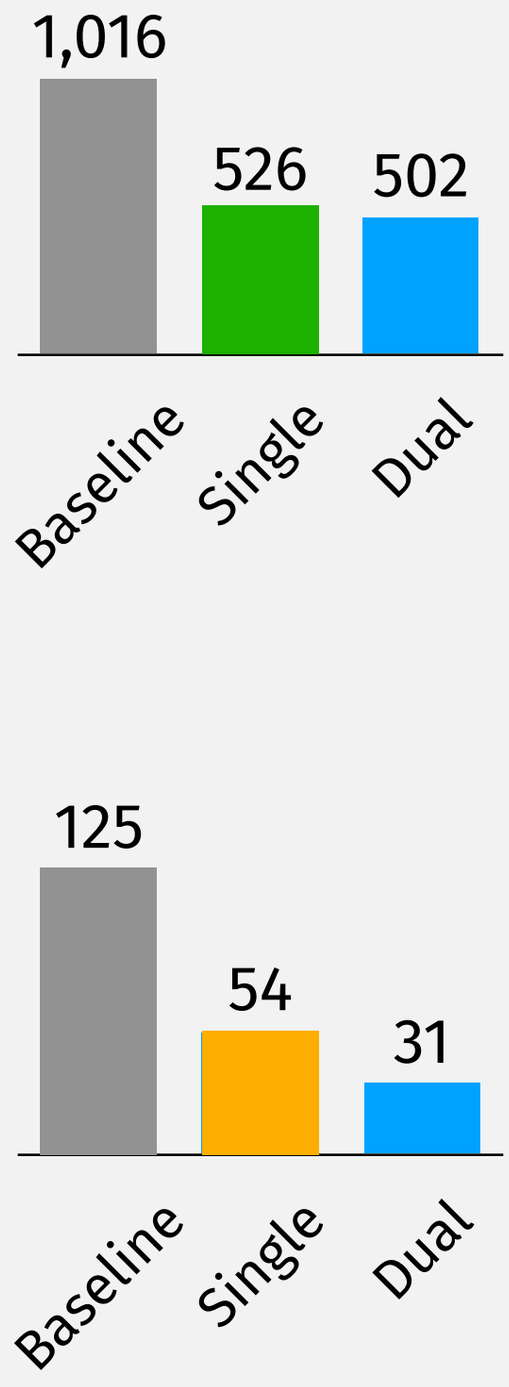
How does the dual architecture perform?

Training

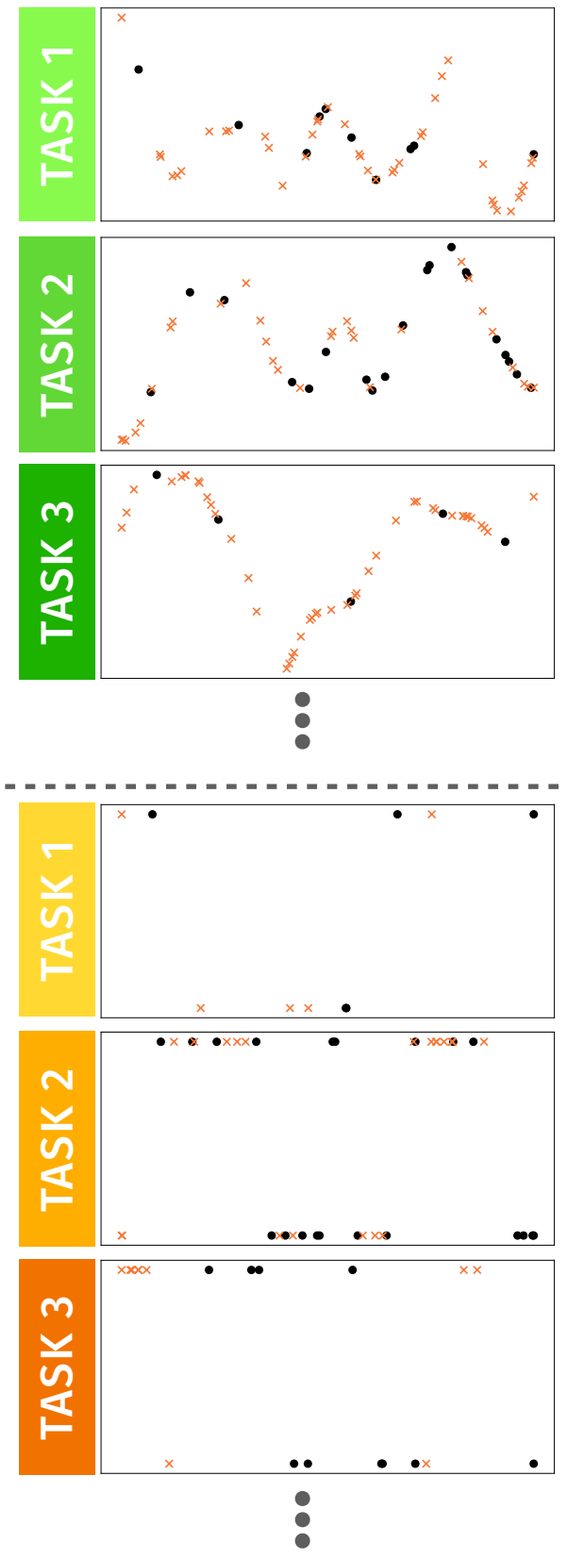


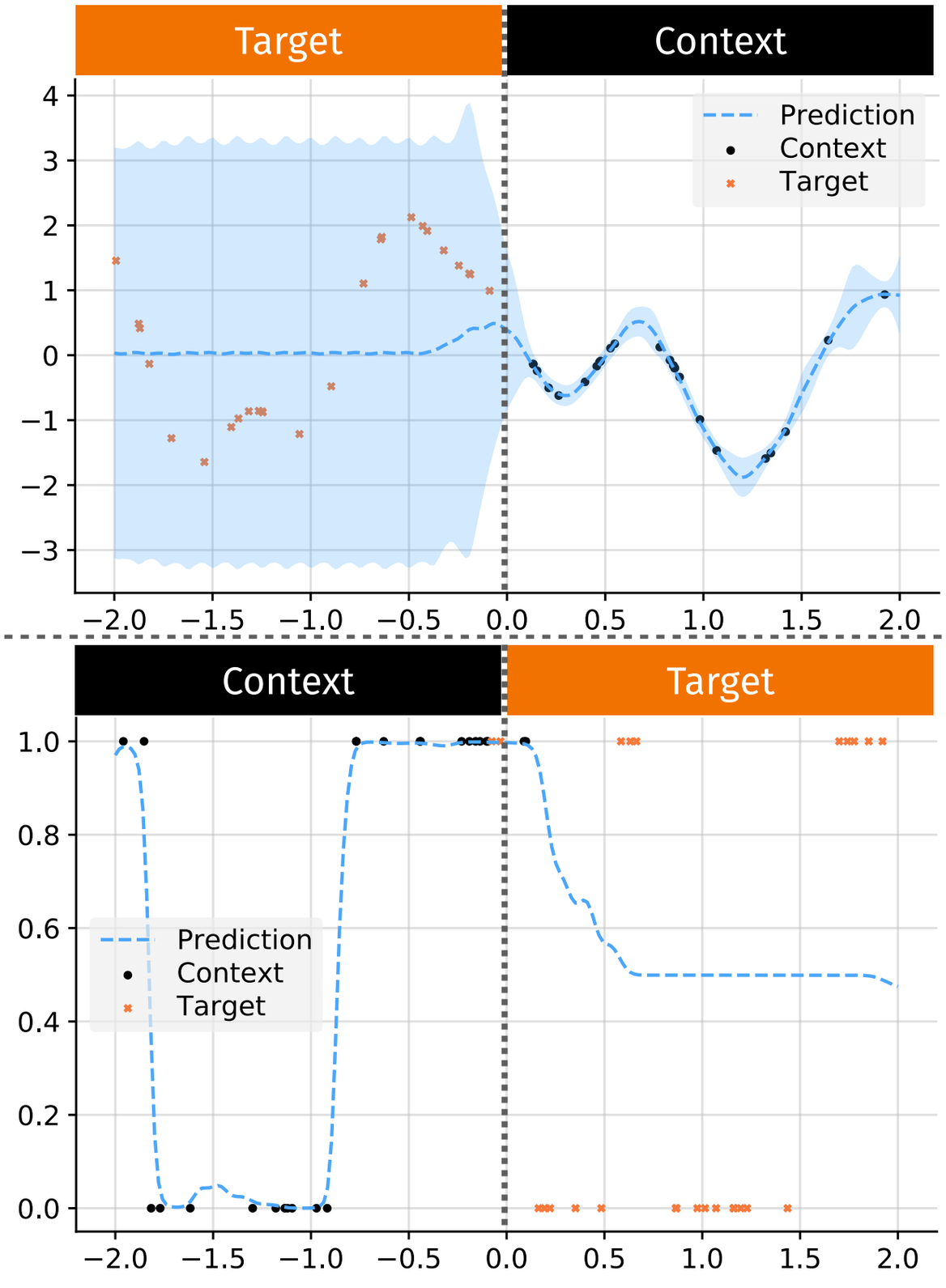


Losses

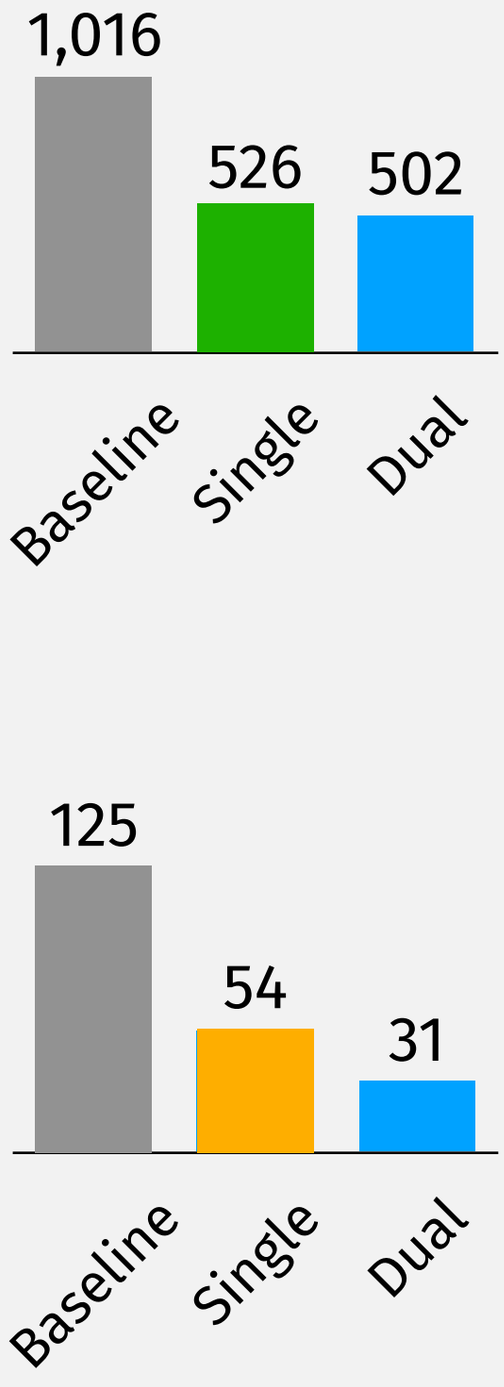


How does the single architecture perform?

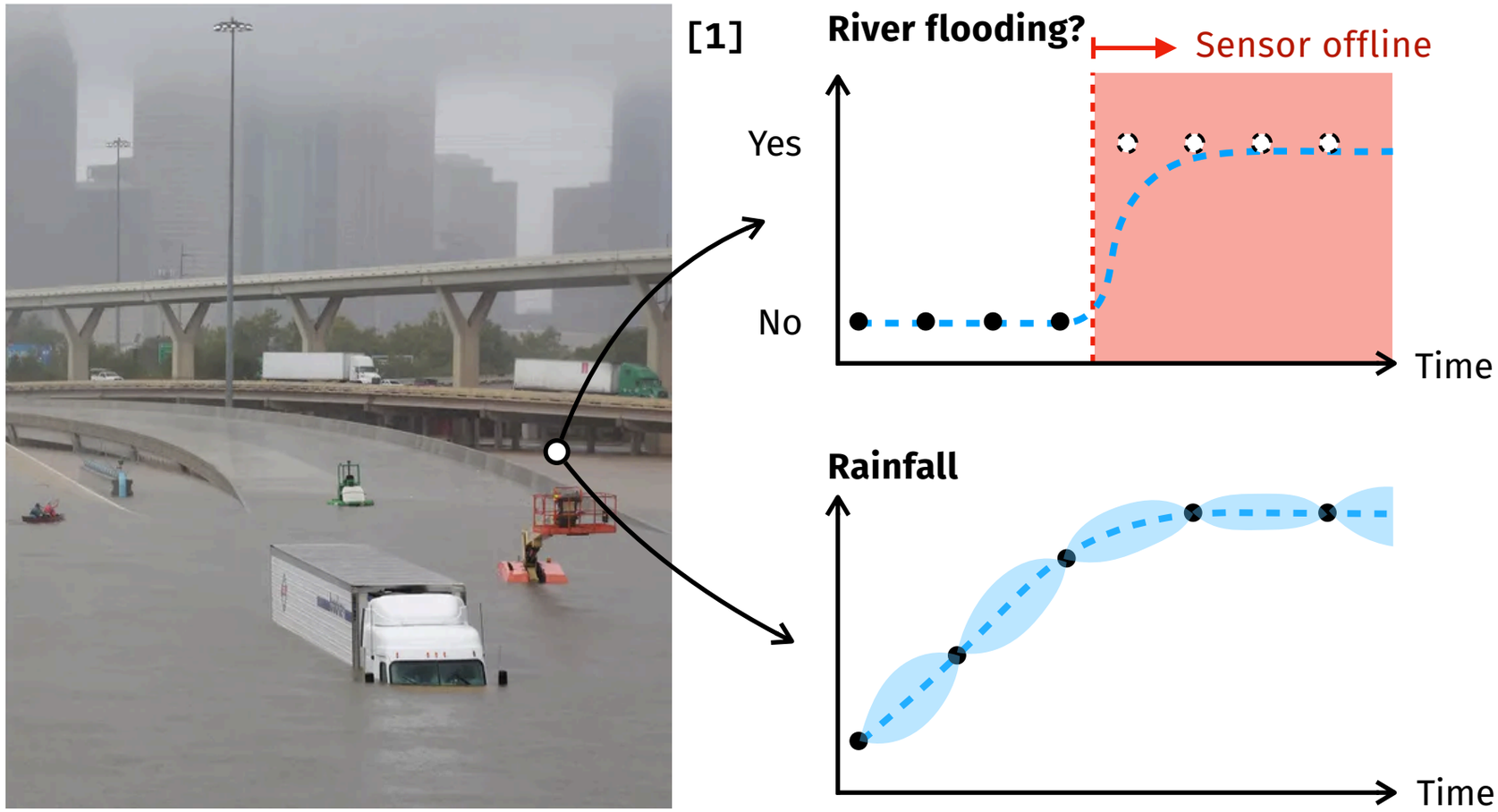




Losses



Conclusion



PLAN

Summer

- ☑ Understand **literature** on neural processes
- ☑ Build **dual architecture** from provided codebase

Term 1

- ☑ Train and test on **synthetic data**

Conclusion

PLAN

Summer

- [x] Understand **literature** on neural processes
- [x] Build **dual architecture** from provided codebase

Term 1

- [x] Train and test on **synthetic data**

Term 2

- [ ] Deploy on **real-world dataset** from environmental science
- [ ] Explore different **computational architectures**

References

1. Livsey, Anna. ‘Before and after: Images Show How Hurricane Harvey Swamped Houston’. *The Guardian*, 29 Aug. 2017. *The Guardian*, https://www.theguardian.com/us-news/2017/aug/29/before-and-after-images-show-how-hurricane-harvey-swamped-houston.

2. Gordon, Jonathan, et al. *Convolutional Conditional Neural Processes*. 2019. openreview.net, https://openreview.net/forum?id=Skey4eBYPS.

3. Dubois, Yann, et al. *Neural Process Family*. 2020, https://yanndubs.github.io/Neural-Process-Family/.