

A Task-Interdependency Model of Complex Collaboration Towards Human-Centered Crowd Work (Extended Abstract)

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Abstract

Mathematical models of crowdsourcing and human computation today largely assume small modular tasks, “computational primitives” such as labels, comparisons, or votes requiring little coordination. However, while these models have successfully shown how crowds can accomplish significant objectives, they can inadvertently advance a less than human view of crowd workers where workers are treated as low skilled, replaceable, and untrustworthy, carrying out simple tasks in online labor markets for low pay under algorithmic management. They also fail to capture the unique human capacity for complex collaborative work where the main concerns are how to effectively structure, delegate, and collaborate on work that may be large in scope, underdefined, and highly interdependent.

We present a model centered on interdependencies—a phenomenon well understood to be at the core of collaboration—that allows one to formally reason about diverse challenges to complex collaboration. Our model represents tasks as an interdependent collection of subtasks, formalized as a task graph. Each node is a subtask with an arbitrary size parameter. Interdependencies, represented as node and edge weights, impose costs on workers who need to spend time absorbing context of relevant work. Importantly, workers do not have to pay this context cost for work they did themselves.

To illustrate how this simple model can be used to reason about diverse aspects of complex collaboration, we apply the model to diverse aspects of complex collaboration. We examine the limits of scaling complex crowd work, showing how high interdependencies and low task granularity bound work capacity to a constant factor of the contributions of top workers, which is in turn limited when workers are short-term novices. We examine recruitment and upskilling, showing the outsized role top workers play in determining work capacity, and surfacing insights on situated learning through a stylized model of legitimate peripheral participation (LPP). Finally, we turn to the economy as a setting where complex collaborative work already exists, using our model to explore the relationship between coordination intensity and occupational wages. Using occupational data from O*NET and the Bureau of Labor Statistics, we introduce a new index of occupational coordination intensity and validate the predicted positive correlation. We find preliminary evidence

that higher coordination intensity occupations are more resistant to displacement by AI based on historical growth in automation and OpenAI data on LLM exposure. Our hope is to spur further development of models that emphasize the collaborative capacities of human workers, bridge models of crowd work and traditional work, and promote AI in roles augmenting human collaboration. The full paper can be found at: <https://doi.org/10.48550/arXiv.2309.00160>.